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PACIFIC OCEANIC FISHERY
INVESTIGATIONS

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

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ZOOLOGY—VOL. X.

PART XXVI.—REPORT ON THE NUDIBRANCHIATA

BY DR. RUDOLPH BERGH

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EDITORIAL NOTE.

Dr. Rudolph Bergh of Copenhagen, who is well known to Naturalists from his numerous Papers on the Nudibranchiata, undertook the description of the specimens belonging to that group collected by the Expedition, and this Memoir gives the result of his investigations. The Manuscript was received on the 7th July 1883—partly written in English and partly in German—the latter being translated into English by the Naturalists on the Editorial Staff.

John Murray.

Challenger Office, 32 Queen Street,
Edinburgh, 24*th September* 1884.

ERRATA.

REPORT ON THE NUDIBRANCHIATA (PART XXVI.).

Page 16, line 8 from foot, *for* "Atlantic" *read* "Pacific."
Page 31, at top, *insert* "Family SCYLLÆADÆ."
Page 34, line 9, *insert* "Family BORNELLIDÆ."
Explanation of Plate IV. fig. 5, *for* "in interior of, &c.," *read* "of the everted part of the glans."

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the NUDIBRANCHIATA dredged by H.M.S. Challenger during the years 1873-1876. By Dr. RUDOLPH BERGH, Physician to the General Hospital of Copenhagen.

JUDGING from the number and variety of the species of Nudibranchiata that have been hitherto described from the shores of the tropical seas, it is probable that this part of the world will ultimately prove to be the headquarters of the group. Although up to the present the tropical Nudibranchiata have been but slightly examined in comparison with the northern species, nearly every exploring expedition that has visited the tropics has discovered new and interesting forms of these animals. The Families of the Nudibranchiata are by no means evenly distributed in the different oceans. Of the Æolidiadæ by far the greatest number of species inhabit the northern seas, and only a few species have been described by van Hasselt, Kelaart, Alder and Hancock, Collingwood, Semper, and others, as occurring in the tropical seas.[1] On the other hand, the large and important Family Doridídæ is more abundantly represented both generically and specifically in the tropics.

Since the main object of the Challenger Expedition was the investigation of the deep sea, the number of dredgings made in shallow water was comparatively few; accordingly, as might have been expected, the number of Nudibranchiata collected during the voyage

[1] Van Hasselt only discovered three species, Elliot four or five, Kelaart nine, and Semper four.

Collingwood (Observations on the distribution of some species of Nudibranchiate Mollusca in the China seas. *Ann. and Mag. Nat. Hist.*, ser. 4, vol. i., 1868, pp. 90–94) calls attention to the scarcity of Nudibranchiata on the shores of China, Formosa, Labuan, and Singapore, with respect both to the number of species and of individuals, and contrasts with this the comparative abundance of the group on the English shores. Among the Nudibranchiata collected by Collingwood there was not a single representative of the Family Æolidiadæ.

was not large. The Challenger collection contains altogether twenty-five species, including one deep-sea form of the greatest interest (*Bathydoris abyssorum*).

The following is a list of the species :—

1. *Phylliroë atlantica*, Bergh.
2. *Acura pelagica*, Adams.
3. *Acura lanceolata*, Bergh.
4. *Fiona marina*, Forskål.
5. *Glaucus atlanticus*, Forster.
6. *Janolus australis*, n. gen. and sp.
7. *Cuthonella abyssicola*, n. gen. and sp.
8. *Rizzolia australis*, n. sp.
9. *Scyllæa pelagica*, Linné.
10. *Bornella excepta*, n. sp.
11. *Tritonia challengeriana*, n. sp.
12. *Marionia occidentalis*, n. sp.
13. *Ohola pacifica*, Bergh.
14. *Euplocamus pacificus*, Bergh.
15. *Chromodoris striatella*, Bergh.
16. *Chromodoris runcinata*, Bergh.
17. *Ceratosoma cornigerum*, Adams.
18. *Archidoris kerguelenensis*, n. sp
19. *Archidoris australis*, n. sp.
20. *Discodoris morphæa*, Bergh.
21. *Platydoris eurychlamys*, Bergh.
22. *Thordisa clandestina*, n. sp.
23. *Bathydoris abyssorum*, n. gen. and sp.
24. *Doriopsis nebulosa*, Pease.
25. *Onchidium melanopneumon*, n. sp.

I. Order.—NUDIBRANCHIATA KLADOHEPATICA.

The majority of the forms belonging to this Order which were collected during the expedition are pelagic (*Phylliroë, Acura, Glaucus, Fiona*), some are littoral (*Rizzolia, Janolus*), but only one genus (*Cuthonella*[1]) was obtained from the deep sea.

The genera *Scyllæa, Bornella, Tritonia*, and *Marionia* are transitional between the kladohepatic and holohepatic Nudibranchs.

[1] Up to the present time but one species belonging to the Family Æolidiadæ has been found in deep water—*Goniæolis typica;* this was dredged by M. Sars, at a depth of from 70 to 100 fathoms.—(G. O. Sars, On some remarkable forms of animal life from the great deeps off the Norwegian Coast, part 1, pp. 39–40, Christiania, 1872).

Family Phylliroidæ.

Psilosomata, Blainville, Manuel de Malacol., 1825, p. 484.
Phylliroidæ, Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft v., 1873, pp. 210–246.

Corpus magnopere compressum, altum; postice nonnihil humilius in caudam compressam apice truncatam, vel gradatim attenuatam abiens; antice collo cum capite quasi boviformi conjunctum. Caput sat magnum, rhinophoriis contractilibus, pro parte vaginis retractilibus, simplicibus, elongatis instructum; tentacula nulla.

Bulbus pharyngeus fortis, illi *Pleurophyllidiarum* non dissimilis, ita quoque mandibulæ fortes. Linguæ radula non pauciseriata; dens medianus utrinque denticulatus; dentes laterales non multi, utrinque denticulati.

Glandulæ hermaphrodisiacæ discretæ 3; glans penis conulis armata.

These remarkable pelagic animals were placed among the Pteropoda by the earlier observers (Péron, Lesueur, Blainville); by other systematists (Lamarck, Cuvier, A. d'Orbigny, Cantraine, van der Hoeven, H. and A. Adams) they were incorporated with the Heteropoda; they were transferred to the Salpæ by Rang. Eydoux and Souleyet first clearly showed them to be "nudibranchiate" Gasteropoda, though their affinity with the Gasteropoda had been previously hinted at by Eschscholtz.

This Family contains two genera, *Phylliroë* and *Acura*, if indeed these be really distinct. Numerous memoirs have been published upon the former genus, but the structure of *Acura* was first made known through my Monograph.

The Phylliroidæ have a very remarkable form. The body is high and laterally very compressed; at the posterior end it is lower and passes into a tail, which is either long and filiform (*Acura*), or similar in shape to the body and truncated at its extremity (*Phylliroë*); the head, which is separated from the body by a more or less strongly pronounced "neck," is large and strong and somewhat high; its shape is peculiar, owing to the presence (*Phylliroë bucephala*) of elongated simple *rhinophoria*, which can be retracted into their wide sheaths; there is no trace of any tentacula.

The *bulbus pharyngeus* is very strong and rather high, resembling closely the bulbus of the Pleurophyllidiadæ; the mandibles are rather powerful, somewhat resembling those of the Pleurophyllidiadæ, the cutting edge is densely covered with fine prominences like the teeth of a comb. The small "tongue" is entirely enclosed within the buccal cavity; the radula is made up of an inconsiderable number of thin teeth. On either side of the median tooth, which is finely denticulated on both sides, are usually six lateral teeth, unsymmetrically denticulated on both sides. The *liver* consists of four long cœca, two superior and two inferior. The *kidney* is a long sac, opening internally into the pericardium through the renal syrinx, and externally by a short ureter on the middle of the body. The *hermaphrodite gland* consists of several—usually three—isolated lobes. The *penis*

is very large, the glans covered with small rather soft cones; at the base of the glans is a peculiar wing-like process (*check-wing*).

Phylliroë, Péron et Lesueur.

Phylliroë, Péron et Lesueur, Ann. du Muséum, t. xv., 1810, p. 65, pl. ii. figs. 1–3.
„ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft v., 1873, p. 210.
Eurydice, Eschscholtz, Isis, 1825, I. col. 737, Taf. v. fig. 6.
Philyrine, Menke, Zeitschr. f. Malacozool., 1844, p. 73.

Cauda corporis postice truncata.

Phylliroë differs from *Acura* in having a short truncated tail. The string-shaped spawn of several species is known, as well as the early stages of development.[1]

Several species of this genus, chiefly from the open sea, have been described; most of them, however, will in all probability turn out eventually to be identical,[2] and perhaps the majority are circumæquatorial. I have examined individuals from the Indian Ocean which appeared to be identical with the common Atlantic form.[3]

1. *Phylliroë bucephala*, Péron et Lesueur.
   Mediterranean, Atlantic.

[4]
2. *Phylliroë atlantica*, Bergh.
   Atlantic, Indian Ocean.
3. *Phylliroë rosea*, d'Orbigny.
   Pacific.
4. *Phylliroë lichtensteinii*, Eschscholtz.
   Pacific (near Sandwich Islands).
5. *Phylliroë punctulata*, Quoy et Gaimard.
   Pacific.
6. *Phylliroë rubra*, Quoy et Gaimard.
   Indian Ocean.

7. *Phylliroë amboinensis*, Quoy et Gaimard.
   Bergh, *loc. cit.*, pp. 236–241, Taf. xxix. figs. 16–21, Taf. xxx. figs. 2–5.
   Indian Ocean, Philippines.

[1] A. Schneider, Ueber die Entwickelung der Phyllirhoë bucephalum, *Archiv f. Anat. u. Physiol.*, 1858, pp. 35–37, Taf. iii. A.

[2] MacDonald, *Ann. and Mag. Nat. Hist.*, ser. 2, vol. xv., 1855, pp. 457–460.

[3] Bergh, *loc. cit.*, pp. 229–231.

[4] The bracket indicates my opinion that the species thus connected are more closely related than the others; perhaps even varieties of one species.

Phylliroë atlantica, Bergh.

Phylliroë bucephala, Souleyet, Voy. de la Bonite, Zool., ii., 1852, p. 399–415, pl. xxxv. figs. 1–18.[1]
„ *atlantica*, Bergh, Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxi., 1871, pp. 1302–1305.
„ „ Malacolog. Untersuch., *loc. cit.*, pp. 212–231, Taf. xxviii. figs. 1–18, xxix. figs. 1–15, xxx. fig. 1, xxxi. figs. 1–2.

Sacci hepatici posteriores medio non coarctati. Glandulæ hermaphrodisiacæ paginâ inferiore castaneæ.

This species differs from that of the Mediterranean in the absence of the constriction[2] in the middle of the posterior hepatic sacs, and in the chestnut-brown colour of the underside of the hermaphrodite glands.

A series of thirteen individuals was taken on the surface in the Atlantic near the coast of Africa, 16th August 1873, and off St. Vincent, Cape Verde Islands, 26th April 1876.

Most of the specimens were well preserved and of medium size, the length averaging 12 mm. (without the rhinophoria), and the height 9 mm.; a few were smaller, not measuring more than 8·5 mm. in length. The colour quite as usual.

The form of the animals and the structure of the organs of the body agree perfectly with the previously examined specimens.

The *central nervous system* has been already described by me. H. von Jhering[3] considers that the upper pair of ganglia represent the cerebral, and the lower pair the pleuropedal (visceropedal). I do not believe this interpretation to be right, since the upper ganglia sometimes exhibit a very marked line of division into two parts, and occasionally the upper commissure between the two ganglia is distinctly double, which appears to indicate a separate connection between the two cerebral on the one hand, and the two pleural ganglia on the other. The upper ganglia give off two strong nerves to the walls of the upper part of the body. The visceral commissure certainly in most cases appears to be derived from the inferior ganglia, but the same is the case with the sub-cerebral commissure, which nevertheless has its origin in the upper ganglia. The genital nerve, described by von Jhering, is not the true *nervus genitalis* but the right *nervus pediaeus* (*longus*), which, passing between the windings of the spermatic duct, extends along the walls of the lower part of the body. The true *nervus genitalis* does not seem to be derived from the inferior ganglia. I never saw the commissures uniting the inferior ganglia quite so distinct from each other as von Jhering[4] figures them; the visceral commissure was always free, but the other two

[1] The true *Phylliroë bucephala* of Lesueur and Péron inhabits the Mediterranean (Bergh, *loc. cit.*, p. 231).

[2] In two small individuals, measuring 5 to 6 mm. in length, the underside of the glands was not coloured, and the hepatic sacs had several constrictions. Are these specimens really *Phylliroë bucephala*? (Bergh, *loc. cit.*, p. 235).

[3] Vergl. Anat. d. Nervensyst. d. Moll., Leipzig, 1877, pp. 185–189.

[4] *Loc. cit.*, Taf. ii. fig. 5.

were either fused throughout their whole length, or merely separate at the point of origin. The *eyes* presented no peculiarities of structure. The *otocysts* were considerably larger than the eyes, and were visible in all the specimens examined as chalk-white points of about 0·1 mm. in diameter. In one specimen they were distinctly seen to contain about 100 otoconia of the usual appearance, the largest measuring about 0·013 mm. The structure of the skin, together with its peculiar phosphorescent cells ("cells of Müller," Panceri) has been already described by me.

The *bulbus pharyngeus*, the *mandibles*, and the *tongue* have been already described by me. I made a careful examination of the number of rows of teeth in the radula of three individuals, and found that they were provided with eleven, fourteen, and sixteen respectively. Further back, within the sheath of the radula, there were from three to five fully developed, and two undeveloped series. The total number of rows in the three individuals was therefore eighteen, twenty, and twenty-six respectively. As is usually the case, the oldest (most anterior) row consisted only of a single lateral tooth on either side of the median tooth, and this arrangement (1–1–1) seems to be the original form of the armature of the tongue in the young of these animals. The number of teeth then gradually increases to six or seven. The shape of the teeth was quite typical.

With respect to the *renal organ*, I have nothing to add to my former description.

The *hermaphrodite glands* (in the three specimens examined) were three in number. The ampulla of the hermaphrodite duct and the vas deferens I have already described. In all three specimens the *penis* was invaginated. Behind the middle of the organ there is a lateral prominence, through the wall of which was visible a strong cylindrical or conical organ; behind this, again, a number of fine, whitish, densely set points. When the organ was opened this conical or sometimes wing-shaped prominence was seen to project freely into its interior.[1] With the exception of that portion behind the wing-shaped lateral prominence, where are developed the small cones, the cavity of the penis is smooth and often presents circular folds. The function of this wing-shaped prominence would appear to be to prevent the male organ from being introduced too far into the vagina. Gegenbaur,[2] however, and H. Müller, consider that it serves to fix the organ during copulation, and it cannot be denied that its structure[3] would fit it for this purpose. A portion of the mucous gland in the neighbourhood of the female genital opening, which is of a more yellowish colour, possibly represents the albuminiparous gland. The spermatheca is absent.

[1] Bergh, Malacolog Untersuch., *loc. cit.*, pp. 227, 228, Taf. xxix. fig. 13*a*; xxvii. figs. 21, 22; xxxi. fig. 4*c*; xlv. figs. 1–4.

[2] *Zeitschr. f. wiss. Zool.*, Bd. v., 1854, p. 356.

[3] Bergh, *loc. cit.*, p. 228.

Acura, H. and A. Adams.

Acura, H. and A. Adams, Genera of recent mollusca, vol. ii., 1858 (part ix., 1855), p. 98.
„ Bergh, Malacolog. Untersuch., *loc. cit.*, Heft v. pp. 241–246.

Cauda corporis elongata filiformis.

This genus was established by H. and A. Adams, but remained almost entirely unknown until the publication of my Monograph. I then showed that the two genera *Acura* and *Phylliroë* could not be distinguished by any essential external characters, and exhibited no great differences in their internal structure. I was however unable, owing to the bad state of preservation of the specimens, to find a renal organ in *Acura*. My renewed examination of the animal has clearly shown the presence of this latter organ. The only character by which *Acura* can be differentiated from *Phylliroë* is by the presence inthe former of a *pointed, elongated, mostly filiform tail;* and even this in one species (*Acura lanceolata*, Bgh.) is rather short, and thus establishes a link between *Acura* and *Phylliroë*.

In its biological relations the genus *Acura* very probably entirely agrees with *Phylliroë*.

Only two species are known :—

1. *Acura lanceolata*, Bgh.
Philippine Sea, Pacific.

2. *Acura pelagica*, Ad.
Atlantic.

1. *Acura pelagica*, H. and A. Adams (Pl. X. fig. 4).

Acura pelagica, H and A. Adams, *loc. cit.*, p. 98, pl. lxx. fig. 4.
„ „ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.) Heft v. pp. 242–246, Taf. xxx. figs. 6–19; Taf. xxxi. figs. 3, 4.

Five specimens of *Acura pelagica* were captured in the East Atlantic, off the coast of Africa, on August 16, 1873, and in the South Atlantic, on October 14, 1873. Some specimens were preserved in alcohol, others mounted on slides.

The length of the body (excluding the rhinophoria and the tail) is from 7 to 8 mm.; the tail is nearly as long as or even a trifle longer than the body; the *rhinophoria* were of the usual length. The *colour* was quite typical. The *form of the body* is rather more elongated than in *Phylliröe*, but not so high; in one individual the penis was everted, and appeared to be almost equal in length to the body.

The *central nervous system* entirely resembles that of *Phylliroë*, as do also the eyes and the otocysts; the latter organs are visible beneath the eyes as chalk-white points, they each contain from 150 to 200 otoconia.

The *bulbus pharyngeus* and the mandibles resemble those of *Phylliroë*. I examined the radula in two individuals, and found it to consist of fifteen to sixteen series of teeth. Further back there were only five fully-developed series, but two other imperfectly developed series were present. The total number of series thus amounted to twenty-two and twenty-three in the two specimens. The number of teeth in the series was 6–1–6; their form has been already described by me.

The *salivary glands*, with the rest of the digestive tract and its hepatic sacs, were quite as in *Phylliroë*. The *renal chamber* (fig. 4, *e,e*) long and somewhat irregularly contracted; the *renal syrinx* (fig. 4, *d*) resembles that of *Phylliroë*, and is about 0·2 mm. in length; the *ureter* (fig. 4, *f*) as in *Phylliroë*. Two *hermaphrodite glands* are present, and closely resemble in form and colour those of *Phylliroë atlantica*, as does also the *penis*. There is no spermatheca.

2. *Acura lanceolata*, Bergh.

Phylliroë lanceolata, Bergh, Malacolog. Untersuch., *loc. cit.*, p. 241, Taf. xxxi. fig. 5.

To this species is probably to be referred an *Acura* captured in the West Pacific, on the surface, March 27, 1875. The specimen was preserved on a slide. It measured nearly 13 mm. in length, and 3 mm. in height. The form of the body agrees closely with the figure given by Semper. As far as could be made out, a renal sac was present, and there appeared to be two hermaphrodite glands, as also mentioned by Semper; the hepatic cæca were quite as in the former species.[1]

Family Æolidiadæ.

Of this large Family only a few forms were captured during the expedition.

Fiona, Alder and Hancock.

Fiona, Alder and Hancock,—Forbes and Hanley, British Mollusca, vol. iii., 1853, p. x.
„ Alder and Hancock, Monog. Brit. Nudibr. Moll., part 7, 1855, p. 52, pl. xxxviii. *a*.
„ Bergh, Beitr. zur Kenntn. d. Æolidiaden I., Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, xxiii., 1873, pp. 605–610;—V., *loc. cit.*, xxvii., 1877, pp. 823, 824.
„ Bergh, On the Nudibr. Gastr. Moll. of the North Pacific Ocean (*in* Dall, Scientific Results of the Exploration of Alaska, vol. i., art. v.) part 1, 1879, pp. 85 (141)–88 (144).
Hymenæolis, A. Costa, Annuario del Museo zool. di Napoli, III., 1866, pp. 64–80,—IV., 1867, p. 28.

Corpus elongatum, gracile; rhinophoria et tentacula subsimilia, simplicia. Papillæ (dorsales) cuti firmius affixæ, elongatæ, ob membranam branchialem quasi alatæ; bursa cnidophora nulla. Anus dorsalis dextrorsum situs; aperturæ genitales discretæ, geminæ.

[1] Semper only found three cæca—the antero-inferior being absent. This must be merely an individual abnormality. In a specimen of *Phylliroë atlantica* which I examined, the antero-superior cæcum was reduced to a mere rudiment (Bergh, *loc. cit.*, Taf. xxix. fig. 7*f*.).

Mandibulæ cymbiolatæ, antrorsum sensim angustiores, processu masticatorio breviori subhamato, margine masticatorio singula serie denticulorum armato. Lingua elongata, compressa, serie dentium unica; dentes arcuati, cruribus angustis, acie cuspide prominulo et utrinque denticulis compluribus. Penis inermis.

The genus *Fiona* differs from all the other Æolidiadæ in having a proper branchia attached to the inner side of the dorsal papillæ.

A few species have been described, all pelagic in habit, which do not markedly differ from each other, and may eventually prove to belong to one circumæquatorial cosmopolitan form.

1. *Fiona marina* (Forsk.).
   Atlantic, Mediterranean.
2. *Fiona pinnata* (Eschsch.).
   South Pacific.
3. *Fiona longicauda* (Quoy et Gaim.).
   Pacific (neighbourhood of New Zealand).
4. *Fiona* (?) *alba*, var. (van Hass.).
   Indian Ocean.

Fiona marina (Forskål), (Pl. XI. fig. 1).

Limax marina, Forsk., Descript. Animalium, p. 99; Icon. animal., t. xxvi., fig. *Gg*.
Fiona nobilis, Alder and Hanc., *loc. cit.*, p. 10.
„ *atlantica*, Bergh., Anat. Unters. af Fiona Atlantica, Vidensk. Meddel. f. d. nat. Foren. i Kjøbenh., 1857, pp. 273–337, Taf. ii.–iii.
Hymenæolis elegantissima, Costa, Ann. del Mus. zool. di Napoli, III., 1866, p. 64, 80; IV., 1867, p. 28.
Fiona marina (Forsk.), var., *pacifica*, Bergh, On the Nudibr. Gastr. Moll., &c., *loc. cit.*, pp. 86–88, pl. i. figs. 7, 8.
„ *pinnata* (Eschsch.), Bergh, Beitr. zur Kenntn d. Æolidiaden. I., *loc. cit.*, 1874, pp. 606–610, Taf. viii. figs. 2–11, Taf. ix. fig. 13.

Three specimens of this species were captured on the surface in the north-west Pacific, on June 29th, 1875, and were preserved in picric acid.

The three specimens, no doubt somewhat contracted, were about the same size; the largest measured about 13 mm. in length, 4 mm. in breadth, and 4·5 mm. in height, the length of the tail was 4 mm.

The structure of the central nervous system was quite typical, but the otocysts could not be detected.

The *bulbus pharyngeus* in the two specimens which I examined measured 2·75 and 3 mm. in length. The *radula* contained 15 to 16 series of teeth and 6 to 9 loose teeth

were always seen lying at the root of the tongue, between it and the inferior wall of the buccal cavity (fig. 1). Further backwards there were twenty-one or twenty-two fully developed and two incompletely developed series; the total number of series of teeth was thus thirty-eight (forty-four) and forty (forty-nine) in the two individuals. Each of the teeth was provided with six or seven denticles on either side of the apex.

The oral glands (*glandulæ ptyalinæ*) were present and quite typical, but the true salivary glands (*glandulæ salivales*) were wanting.

It is probable this species is circumæquatoral, and that *Fiona pinnata* (Esch.) and *Fiona longicauda* (Quoy et Gaim.) will turn out to be identical with the common form of the Mediterranean and Atlantic. I have seen series of individuals from different parts of the Southern Ocean, as well as from the Japanese Sea, which in external characters and internal structure presented no differences from the typical form of the Atlantic.

Glaucus, Forster.

Glaucus, G. Forster, A Voyage round the World in the "Resolution," 1777, vol. i. p. 49.
Eucharis, Péron, Voy. de découvertes aux terres australes, 1807–1810, pl. xxix. fig. 2.
Dadone, Gistel, Naturgesch. des Thierreichs, 1848, p. 174.
Laniogerus, Blainville, Manuel de Malacol., 1825, p. 485.
Nausimacha, Gistel, *loc. cit.*, p. 174.
Glaucus, F., Bergh, Anat. Bidr. til Kundsk. om Æolidierne, K. dansk. Vidensk. Selsk. Skrif. R. 5, Naturv. og math. Afdel. vii., 1864, pp. 243–302, Taf. vi.–ix.
„ F., Bergh, Beitr. zur Kenntn. der Moll. des Sargassomeeres, Verhandl. d. k. k. zool.-bot. Gesellsch. Wien., xxi., 1871, pp. 1300–1301.
„ F., A. Vayssière, Observ. sur l'anat. du Glaucus, Ann. d. Sci. Nat., sér. 6, t. i., 1874, pp. 1–17, pl. viii., ix.

Rhinophoria et tentacula fere rudimentaria, simplicia. Truncus, præsertim antice, quasi applanatus, lateribus tanquam brachiis duobus dilatatus, in quibus papillæ linea curvata (vel lineis) impositæ; in parte posteriore trunci utrinque præterea series papillarum duæ obliquæ. Cauda elongata. Podarium sat angustum antice truncato-rotundatum.

Mandibulæ validæ, convexitate duplici, supera altiore et breviore, inferiore longiore; mandibulæ superne præterea lamina horizontali prædita; processus masticatorius serie denticulorum armatus. Radula dentibus uniseriatis validis.

Glans penis hamo curvato forti armata, vel inermis.

These animals were first scientifically examined by one of the best naturalists of the earlier part of the eighteenth century, F. Ph. Breyn. He captured numerous specimens in the Mediterranean close to the Island of Iviça, and sent a communication to the Royal Society[1] concerning these animals and some Porpitæ which were obtained at the same time.

[1] De plantis et insectis quibusdam rarioribus, *Phil. Trans.*, vol. xxiv., 1705, p. 2054, pl. ii. fig. 4; *Ephem. Nat. Cur. Cent.*, vols. v. and vi., 1717, App. pp. 104, 105, Taf. xiv. fig. 4.

Half a century later[1] another communication was made to the Royal Society by the learned A. P. du Pont, on some specimens of the same animal which had been sent to him by a friend in Jamaica. Gmelin, ignorant of the earlier memoir of Breyn, established, on the strength of the latter memoir of Du Pont, a new species, which is described in his Systema Naturæ[2] under the name of *Doris radiata*. Previously, however, to the publication of Gmelin's work, the animal had been recognised as the type of a new genus by Forster. The two Forsters (J. Reinhold and George), who accompanied Captain Cook on his second voyage, observed the animal during the cruise to the Cape, and the elder Forster gave it the name *Glaucus* ("nomen ex deo marino et colore animalis")[3]. Forster seems to have kept up a correspondence with Blumenbach, and to have sent him an account of the new genus, which was published in his manual of natural history. Gmelin also had received, either from Forster himself or from Blumenbach, some account of *Glaucus*, but he does not seem to have perceived the identity of this form with the Mollusc which he had already described as *Doris radiata*.[4] A few years later (1795) Poli changed the name into *Glaucoderma*.[5] The elder Forster (J. R.) left among his papers a short treatise on the genus *Glaucus*, which was subsequently published by Blumenbach, with additional notes, in Voigt's Magazin,[6] and about the same time a figure of the animal by Blumenbach appeared in the 5th part of his Abbildungen Nat. Gegenst.[7] From these two last mentioned publications dates our knowledge of this animal. Cuvier[8] adopted the generic name of *Glaucus*, chiefly, however, on account of the description given of the animal by the French naturalist Péron.[9]

After Forster several French naturalists who accompanied various scientific expeditions published descriptions of this interesting form. La Martinière, who was the companion of La Peÿrouse, and shared his fate, sent some scientific communications with remarks on these animals to the editors of the Journal de Physique; an abstract of these is to be

[1] An account of a remarkable marine insect, *Phil. Trans.*, vol. liii., 1763, pp. 57, 58, pl. iii.

[2] Systema Naturæ, vi., 1780, p. 3105.

[3] G. Forster, *loc. cit.*, p. 49. "Monday, 14th Sept. 1772. We had also at various intervals found the sea covered with animals belonging to the class of Mollusca, one of which, of a blue colour, in shape like a snail, with four arms divided into many branches, was named *Glaucus atlanticus*."

[4] With his usual carelessness, Gmelin (*loc. cit.*, p. 3149) had not remarked that the "vermis marinus" of La Martinière was a form nearly identical with the species of Du Pont, and considered it to be a "*Clio*."

[5] The *Glaucus* of Klein (Hist. nat. pisc. missi., v., 1749, p. 3), seems to be the *Naucrates* of Rafinesque.

[6] Voigt, *Magazin*, v. 4, April 1803, p. 336, Taf. viii. This "Magazin für den neuesten Zustand der Naturkunde" (i.–xii., 1796–1806) is not to be confounded with the continuation of Lichtenberg's "Magazin für das Neueste aus der Physik und Naturgeschichte" (i.–xii., 1781–1797), which was also edited by Voigt. The article cited here is found reproduced in Lichtenberg's, Forsteri descript. animal., 1844, pp. 10–12.

[7] Blumenbach, Abbild.-Natur. Gegenst., i–x., 1796–1810, Taf. xlviii.

[8] *Ann. du Museum*, vi., 1805, p. 426, Règne anim., &c.

[9] Péron (Péron et Lesueur, Hist. de la fam. des moll. Ptérop., pp. 75, 80, pl. ii. fig. 9,—*Glaucus australis*, *Ann. du Mus.*, t. xv., 1810) regarded *Glaucus* as belonging to the Pteropoda, although Cuvier had already, only by the help of Péron's drawings, assigned the animal to its proper place ("in the neighbourhood of the Scyllææ and Tritoniæ").

found in the number of the journal for November 1787 [1]; a figure of *Glaucus* was published somewhat later in the "Voyage."[2] Another French zoologist, Bosc, observed a similar form in the Atlantic, but described it as a *Scyllæa*.[3] A more extended account of the animal was given by the two naturalists who accompanied the South Sea Expedition of Captain Baudin. Bory de St. Vincent left the expedition in 1802, and on his return published his Voyages aux quatres principales îles d'Afrique, which appeared in the year 1804; on pl. vi. fig. 1 A, B, of this work is a figure of a *Glaucus*, which seems to differ from Forster's species, and was regarded by Lesson as identical with that described by Bosc, to which the name *Glaucus boscii* had been given. Péron, the other companion of Baudin, also made some observations upon this animal, and had it figured by Lesueur. In his large work[4] he created for it the generic name *Eucharis*, but subsequently restored the original name of *Glaucus*.[5] The species which Péron described as new, under the name of *Glaucus eucharis*, Pér.,[6] forms a part of the collection *Glaucus hexapterygius* of Cuvier. Other travellers:—Eschscholtz, Rang, Lesson, d'Orbigny, Quoy and Gaimard, and Souleyet, had frequently the opportunity of seeing these animals, nevertheless their descriptions as well as figures are nearly always valueless. Some malacologists have considered that all these descriptions refer to one and the same species (Lamarck, Blainville,[7] Quoy et Gaimard, Souleyet), others consider that there are no less than six (Lesson, Gray).[8]

In 1864 the present author published a monograph of the genus, chiefly anatomical. Previously to this but little had been known about their structure. Cuvier[9] does not appear to have studied the anatomy of this form, since he places it near the Tritoniæ, and the notes of Blainville[10] are not of any real value. Quoy and Gaimard[11] made some observations on the anatomy of *Glaucus*, and gave a description and figures of the jaws, penis, and spawn. Lovèn subsequently described the radula.[12] The first important description of the structure of *Glaucus* was given by Souleyet,[13] who clearly demonstrated its affinities with the Æolidiadæ.

[1] *Journ. dePhysique*, t. xxx. 2, 1787, p. 366, pl. ii. fig. 5.

[2] Voyage de la Peÿrouse, t. iv. p. 71, pl. xx. figs. 15–16.

[3] Bosc, Hist. nat. des Vers, I. (an X.) p. 87, pl. iii. fig. 3.

[4] Voy. de découvertes aux terres australes, 1807, 1810, pl. xxix. fig. 2.

[5] Blainville, Dict. d. Sci. Nat., t. xix., 1821, p. 37.

[6] Perhaps this species is identical with *Glaucus australis* of the same author, and thus with *Glaucus peronii* of Lesson.

[7] Mostly from notes made by Lesueur (Dict. d. Sci. Nat., *loc. cit.*, p. 37).

[8] According to Gray (Guide to Moll. in Brit. Mus., part 1, 1857, p. 222) these species are *radiatus, atlanticus, draco, forsteri eucharis, pacificus*. The first two are identical, and form, together with *Glaucus forsteri*, the typical form *Glaucus atlanticus*. *Glaucus eucharis* of Lesson, from Mozambique Sea, is perhaps a separate species, as also the two species described by Eschscholtz from the Pacific, *Glaucus draco* and *pacificus*.

[9] Règne anim., Ed. II., 1830, iii. p. 54.

[10] Dict. d. Sci. Nat., xix., 1821, pp. 35–37.

[11] Voy. de l'Astrolabe, Zool. Moll., 1833, pl. xxi. figs. 6–14.

[12] *Öfversigt k. Vetensk.-Akad. Förhandl.*, 1847, p. 175 (189 !), Tab. 3, *Glaucus hexapterygius*.

[13] Voyage de la Bonite, Zool., t. ii., 1852, pp. 440–442, pl. xxiv.

The most conspicuous external character of this genus consists in the *armlike lateral prolongations* of the anterior part of the body, which are especially developed in *Glaucilla*. Of these arms there are two pairs, the anterior being much stronger than the posterior. Sometimes the rudiment of a third pair is visible in a small cushion-shaped prominence. On the outer part of these arms are situated the papillæ, generally in a single series, but sometimes (*Glaucilla*) in several series. In addition to these three groups of papillæ there is, at any rate in large specimens, a fourth series. This is probably to be found in all the species of *Glaucus*, though only three groups have been described by several authors. The papillæ are long and conical in shape, and become easily detached from the body. The body terminates in a long thin tail. The rhinophoria, which have a simple conical shape, are but slightly developed; the conical tentacles are small. The foot is rather narrow; the anterior extremity is truncated and rounded with very slightly prominent edges.[1] The genital aperture is situated behind the first arm, and the anus behind the second, slightly anterior is the opening of the renal organ.

The colour of these animals is remarkable. The under side of the body as well as of the papillæ is a fine ultramarine blue; the upper surface is greyish but with a more or less strongly marked silver tint, which is also visible on the under surface. According to the observations of Reinhardt, made during the "Galathea" Expedition, this silver colour disappears when the animals are removed from the influence of sunlight.[2]

In the form of its jaws *Glaucus* differs from all other Æolidiadæ; they show a double convexity, and at the upper part are continuous with a horizontal plate. The radula only contains a single series of teeth, which are of the usual form with a prominent point, and on either side a series of strong denticles.

Unlike what is found in most other Æolidiadæ (*pleuroproctæ*), the common bile duct (the prolongation of stomach) lies beneath instead of above the hermaphrodite gland, as also in the *Tethydæ*, *Dendronotidæ*, *Dotidæ*, and *Proctonotidæ*. The papillæ dorsales are always provided with an urticating apparatus. The *penis* is always very strong and curved, and in the proper Glauci, armed with a strong curved hook.

These animals inhabit the warmer parts of all the open seas, extending as far as 35° or 36° on either side of the equator, but rarely beyond.[3]

According to the observations of several naturalists (Chamisso, Eisenhardt, d'Orbigny,[4] Reinhardt[5]), their movements are but slow, hence the old name of "Lacertæ marinæ" would appear to be somewhat inappropriate. Bennett, however (Proc. Zool. Soc., iv., 1836,

[1] The foot, therefore, is rather well developed, and it is not easy to understand how Lesson (Voy. de la Coquille, Zool., t. ii. p. 286) could have written—"Le pied est nul à moins qu' on ne prenne pas pour rudiment de pied la ligne moyenne argentée qui suit toute la longueur du ventre."

[2] Bergh, K. Dansk. Vidensk. Selsk. Skrif. R. 5, Bd. vii., 1864, pp. 247–248. Bennett (*Proc. Zool. Soc.*, vol. iv., 1836, p. 117) mentions the rapidity with which these animals change their colours when dying.

[3] Bergh, *loc. cit.*, pp. 249, 254. [4] Voy. aux îles Canaries, p. 42. [5] Bergh, *loc. cit.*, p. 249.

p. 118), remarks on the great mobility of the tail, which may possibly have suggested a comparison with the tail of a Lizard to the older naturalists. They appear never to swim actively about, but merely to float on the surface of the sea with the foot uppermost, the papillæ serving as "balancers."[1] According to Bory de St. Vincent and Forster[2] this position is sometimes reversed, but Reinhardt did not observe this. These animals take in and expel air through the mouth (Forster, Bennett, Reinhardt), and Reinhardt[3] states that immediately after the expulsion of air-bubbles, a bluish fluid, not readily soluble in sea water, is evacuated. This fact is also noticed by Forster[4] and Bennett;[5] the latter, however, describes the fluid as brownish in colour, and regards it as being of a fœcal nature. In the specimens of *Glaucus* which I examined, there was nearly always a quantity of air in the stomach, which was readily expelled from the mouth, together with a violet-coloured liquid, on applying a slight pressure to the back of the animal. The contractility of the body and its appendages is very great, and accounts for the differences that exist in the figures given by various authors. The papillæ of the body are readily detached, as in many other Æolidiadæ. According to Forster,[6] this is also the case with the tail; I very rarely saw an individual, however, that was without a tail.

According to Vayssière, *Glaucus* is phosphorescent. Its food appears to consist chiefly of *Velella* and *Porpita*.[7] Quoy and Gaimard[8] were the first to give a description of the spawn of *Glaucus;* it has since been figured and described by Souleyet,[9] and by myself.[10] D'Orbigny[11] states that the spawn is deposited upon the disc of *Velella*. Copulation has been observed and described by d'Orbigny and Lesson,[12] and I have myself[13] noticed individuals which appeared to be in the act of copulation. The development is up to the present quite unknown.

When preserved in alcohol, these animals become very much altered in shape, and for this reason very different accounts have been given of the number of species which exist. Most observers who have seen the living animals, distinguish several species (Rang 2, Eschscholtz and Reinhardt 4, Lesson 6); those, on the other hand, who have

[1] The assertions of some naturalists that *Glaucus* is able to swim by means of the "gills" were denied by Chamisso and Eisenhardt (*Nov. Act. Nat. Cur.*, X., 1821, p. 347), as well as by Eschscholtz (Zool. Atl., Heft 4, 1831, p. 16). The statement of the last-mentioned author that the animal swims by means of air-bubbles under the "ventral disc" (*loc. cit.* and *Isis*, 1825, I. col. 737) means really that it is kept floating at the surface of the water by help of the swallowed air. A. Adams (*Ann. and Mag. Nat. Hist.*, ser. 2, vol. xix., 1857, p. 462) appears to have noticed this habit of swallowing air, and Forster many years ago (Voigt, *Magazin, loc. cit.*, p. 361) saw the expulsion of air-bubbles through the mouth ("per os spirant").

[2] Voy. de la Coquille, t. ii. p. 284. Voy. aux quatres îles d'Afrique, I., p. 136, pl. vi. fig. 1, A.B. Voigt, *Magazin*, &c, *loc. cit.*, p. 341.

[3] Bergh, *loc. cit.*, p. 250. [4] Voigt, *Magazin*, &c., Bd. v., 1803, p. 341. [5] *Loc. cit.*, p. 115.

[6] Voigt, *Magazin*, &c., p. 341. [7] Bennett, *loc. cit.*, pp. 113–119; Bergh, *loc. cit.*, p. 251. [8] *Loc. cit.*, p. 279.

[9] Voyage de la Bonite, p. 442, pl. xxiv. fig. 25.

[10] Bergh, *loc. cit.*, pp. 281, 291, 293, 298, 302, Taf. vii. fig. 18. In Gray's Figures of Molluscous Animals (vol. iii. pl. cci. fig. 6*a*) the spawn is not well represented (after a drawing of Hooker?).

[11] Voy. aux îles Canaries, p. 42. [12] *Loc. cit.*, pp. 280, 287. [13] Bergh, *loc. cit.*, p. 282, Taf. vii. fig. 14.

only seen specimens preserved in spirit, consider that there is but one circumæquatorial species (Lamarck, Blainville). Reinhardt, who accompanied the expedition of the Danish ship "Galathea" (1845–48), paid special attention to these creatures, and made a good many notes upon them; these notes, together with some beautiful coloured drawings of the living animal, which were executed by the artist of the expedition, were kindly placed at my disposal. Reinhardt considers that there are several species of *Glaucus*, which perhaps may be identical with some of the species of earlier authors. It is impossible, however, to speak positively.

Glaucus may be divided into two sub-genera,—*Glaucus* and *Glaucilla*.

Sub-Genus 1. *Glaucus* (Forster).

Caput parvum; corpus gracilius, longicaudatum; brachia breviora, papillis uniseriatis. Penis hamo armatus.

1. *Glaucus atlanticus*, Forster.

   Mediterranean,[1] Atlantic.

2. *Glaucus gracilis*, Bgh.

   Glaucus gracilis, Bergh, *loc. cit.*, pp. 285–287.

   Atlantic.

3. *Glaucus lineatus*, Reinhdt., Bgh.

   (?) *Glaucus peronii*, Lesson, Voyage de la Coquille, Zool., t. ii. 1, 1826, p. 288.
   (?) „ *flagellum*, Blumenbach, Voigt, Magazin, Bd. v. 4, 1803, p. 336, Taf. viii.
   „ *lineatus*, Bergh, *loc. cit.*, pp. 287–291, Tab. viii. A.

   South Pacific.

4. *Glaucus longicirrus*, Rhdt., Bgh.

   North Pacific.

5. *Glaucus eucharis*, Lesson.

   Sea off Mozambique.

[1] Besides Breyn, who was the first to describe the animal (1705), Rang (Man. de l'hist nat. d. Moll., 1829, p. 126) is the only naturalist who mentions the occurrence of *Glaucus* "in large swarms" in the Mediterranean. Neither the later French nor the Italian malacologists appear to have noticed its presence in this sea.

Sub-Genus 2. *Glaucilla*, Bergh.

Glaucilla, Bergh, *loc. cit.*, p. 295.

Caput validum; corpus subventricosum, brevicaudatum; brachia magis prominentia, papillis pluriseriatis. Penis inermis.

1. *Glaucilla marginata* (Reinh.), Bgh.

Glaucilla marginata, Bergh, *loc. cit.*, pp. 296–300, Tab. ix. A.

North Pacific.

2. *Glaucilla briareus* (Reinh.), Bgh.

South Pacific.

Glaucus atlanticus,[1] Forster (Pl. XIV. fig. 16).

Hirudo marina, Breyn, Phil. Trans., No. 301, vol. xxiv., 1705, p. 2045, pl. ii. fig. 4.
„ „ Du Pont, Phil. Trans., vol. liii., 1763, p. 57, pl. iii.[2]
Glaucus atlanticus, Forster, Voyage round the World in the "Resolution," 1877, vol. i. p. 49.
Voigt, Magazin, Bd. v. p. 4, 1803, p. 336, Taf. viii.
„ „ Blumenbach, Abbild. naturg. Gegenst., Taf. xlviii.
„ „ Lichtenstein, Forsteri descr. anim., 1844, p. 11.
Doris radiata, Gmelin, Syst. Nat., vi., 1790, p. 3105.
Scyllæa margaritacea, Bosc, Hist. nat. des Vers, t. iii., 1802, p. 101, pl. iii. fig. 8.
„ „ B. Bory de St. Vincent, Voyage aux quatres principales îles de l'Afrique, pl. vi. fig. 1, a, c.
Glaucus hexapterygius, Cuvier.
„ *octopterygius*, Cuvier.
„ *boscii*, Lesson, Voyage de la Coquille, Zool., t. ii. 1, 1826, p. 288.
„ *forsteri*, Lamarck.
„ „ L., Quoy et Gaimard, Voyage de l'Astrolabe, Moll., p. 279, pl. xxi. figs. 6–14.
„ *radiatus*, d'Orb., Voy. aux îles Canaries, p. 42.
? *Laniogerus elfortii*, Blainville, Manuel de Malacol., 1825, p. 485, pl. xlvi. fig. 4.
blainvillei, Goldfuss, Handb. d. Zool., 1820, Bd. i. p. 655.
Glaucus atlanticus, F., Bergh, K. dansk. Vidensk. Selsk. Skrif. R. 5, Bd. vii. p. 253–285, Tab. vi., vii.

One specimen was taken in the Atlantic ("August to September 1875") lat. 2° 34′ N., long. 149° 9′ W., at the surface, and another on May 5, 1876. The first specimen was small, measuring only 5·5 mm. in length, 2·5 mm. in breadth, and 1·6 mm. in height.

[1] *Glaucus tetrapterygius*, which Rang (Man. de l'hist. nat. d. Moll., p. 126) described as having "two pairs of gills," is after all probably a doubtful species, as is also a form figured and described in the *Mag. Nat. Hist.*, vol. vi., 1833, p. 318 (extract of the voyage of Mathews to and in Brazil).

[2] In a large treatise (Titius, Gemeinnützige Abhandl. i., 1768, p. 271), Hanow, a professor in Dantzic, endeavoured to show that the animal described by Du Pont was the young of *Squalus squatina!*

The *relative proportions* of the parts of the body were quite typical. The colour has been already described.[1] The dorsal papillæ of the two first groups are arranged in arches, the first of which was the largest and appeared to be complete, containing from ten to eleven papillæ; one of these papillæ is very large, its length about equalling the diameter of the body of the animal; at the side of this another rather large papilla, and the papillæ following this decrease in size towards the ends of the arch. The second arch contains a smaller number of papillæ (6 to 8), of which one is much larger than the others. Behind this comes a short row of two small papillæ, but no trace of a fourth group could be detected.[2] The arrangement of the papillæ and their form has been already described by me.

The viscera are conspicuously apparent through the walls of the body.

The *nervous system* has been thoroughly investigated by myself[3] and by Vayssière and v. Jhering.[4] According to the last-mentioned author, the central nervous system closely resembles that of *Phylliroë*, the "cerebro-pleural (cerebro-visceral) ganglia" of my monograph being in reality equivalent to the cerebral ganglia only of other molluscs, and the ganglia described by me as "pedal" being really composed of the fused pleuro-pedal (viscero-pedal) ganglia. This view I do not believe to be correct. The upper ganglia show an indistinct division into two parts, and since the development of the foot of *Glaucus* is not inferior to that of many other Æolidiadæ, or indeed of many Nudibranchiata in general, there is every reason to suppose that it agrees with these latter in possessing isolated pedal ganglia. According to von Jhering and other authors, all the commissures originate from the lower ganglia. This statement is not correct; the visceral commissure, at any rate, can be traced up to the lower side of the upper ganglia.

The *otocysts* contain from 20 to 28 otoconia. The eyes typical.

The *bulbus pharyngeus* measures 1·5 mm. in length. The mandibles typical, the masticating edge (Pl. XIV. fig. 16) being provided with a single series of pointed denticles, the largest of which measure ·0125 mm. The *radula* has twelve teeth; farther back six developed and two undeveloped teeth. Each tooth has from seven to eight denticles. The digestive system, renal organ, and urticating bag, have been already fully described by me. The latter organ is filled with urticating cysts and free urticating elements of the usual form, among which are several larger ones of a peculiar character.[5]—The genital system I have described elsewhere; the penis is typical in shape, having at its extremity a dirty yellowish coloured hook, measuring about 0·18 mm. in length.

[1] Bergh, Bidr. til Kundsk. om Æolidierne, *loc. cit.*, 1864, p. 256.

[2] In small specimens (6 to 7 mm. in length) previously examined by me (*loc. cit.*, p. 259), there was invariably a small rudiment of a fourth group, sometimes represented merely by a single papilla. In very small specimens (2 to 3 mm. in length) there was no trace of a fourth or even of a third group (pp. 283–284).

[3] Bergh, *loc. cit.*

[4] H. v. Jhering, Vergl. Anat. d. Nervensyst. d. Moll., Leipzig, 1877, pp. 183–185.

[5] Bergh, *loc. cit.*, p. 276, Taf. vi. fig. 29 **.

This specimen, like almost all the other specimens of *Glaucus atlanticus* dissected by me, was infested by *Distoma glauci*,[1] a form closely allied to *Distoma appendiculatum* of G. Wagner.[2] The animal (Pl. X. figs. 5–17) varies in length from ·41 mm. to 1·27 mm. The suckers are very large, the posterior nearly double the size of the anterior, measuring in large individuals ·16 mm. by ·2 mm. The tail was nearly always more or less retracted, sometimes entirely concealed (fig. 5). In several individuals (perhaps of a different species ?) there was no tail, and the hinder part of the body was filled with yellowish egg-like bodies (fig. 10).

Glaucus longicirrus, Reinhdt., Bergh. ?

(?) *Glaucus pacificus*, Eschsch., Zool. Atl., Hft. 4, p. 16, pl. xix. fig. 4.
„ „ Lesson, Voyage de la Coquille, Zool., t. ii. p. 288.[3]
Glaucus longicirrus, Bergh, *loc. cit.*, pp. 291–295, Taf. viii. B.

A specimen of *Glaucus* captured in the Pacific at the surface, July 1875, perhaps belongs to this species.

The specimen was preserved on a slide in glycerine, and measured 12 mm. in length. The number of papillæ on the first arm was fifteen or sixteen, on the second eight or nine; in the third series there were from five to six, and there seemed to be a fourth group with one or two papillæ. The longest papilla measured 7 mm.

Glaucilla briareus (Reinhdt.).

(?) *Glaucus draco*, Eschsch., Zool. Atl., Heft 4, p. 16, Taf. xix. fig. 5.
„ „ E., Lesson, Voy. de. la Coquille, t. ii. p. 288.
(?) *Glaucus distichoichus*, d'Orb., Voy. dans l'Amér. mérid., 1844, p. 196, pl. xiv. figs. 1-3.
Glaucilla briareus, Bergh, *loc. cit.*, pp. 300–302, Taf. ix. B.

Three small specimens captured in March 1875, in the West Pacific, belong possibly to this species, but having been, like the last species, very badly preserved, it is impossible to speak with certainty.

The length of the body was from 1·5 to 3 mm. The number of papillæ appeared to be smaller than in the original specimens examined by me.

Janolus, n. gen.

Forma corporis cum crista interrhinophoriali et ano postico-mediano sicut in *Janis*, limbus podarii latus.

Mandibulæ colosseæ, margine masticatorio non denticulato. Dentes mediani linguæ hamo rudimentario ; laterales numerosi, angusti, hamo breviori curvato.

[1] Bergh, *loc. cit.*, pp. 282–283.

[2] G. Wagner, *Archiv f. Naturgesch.*, Jahrg. xxvi. Bd. i., 1860, pp. 165–194, Taf. viii., ix.

[3] Reinhardt regarded the last two forms as specifically distinct, merely on account of a difference in colour.

This new group is allied to the genus *Janus*, and resembles it in the outward form of the body, in the arrangement of the dorsal papillæ, in the condition of the head, with its tentacles and rhinophoria, in the median position of the anal papilla on the posterior dorsal surface, and in the presence of the peculiar comb-like organ between the rhinophoria.[1] It differs, however, by the presence of a broad foot-brim, which probably assists the animal in swimming. This genus, however, is mainly distinguished by the enormous development of the mandibles, which, unlike what is found in *Janus*, form the sides of the bulbus; the lower portion of the mandibles resembles that of *Janus*, but the masticatory edge differs in so far as it is not provided with denticles as in the typical *Janus*. The radula is like that of *Janus;* the median series of teeth weak, with rudimentary hook; the lateral teeth numerous, with short recurved hook. In its internal structure the genus *Janolus* agrees on the whole pretty closely with *Janus*.

The two genera belong to a special group, which includes also the Proctonotidæ and the Madrellæ.[2] *Janolus* differs from the Proctonotidæ by the comb-like organ between the rhinophoria, and from the Madrellæ, moreover, by the dorsal position of the anus, by the presence of special tentacles, and by the numerous lateral teeth on the *radula*.

Only one species of this genus is known at present.

Janolus australis, n. sp. (Pl. VIII. figs. 15–22, Pl. IX. figs. 6–8).

Habitat.—Pacific (Arafura Sea).

A single example of this species was taken in the Arafura Sea, during September 1874. The specimen was treated with picro-sulphuric acid, and preserved in alcohol. The dorsal papillæ were nearly all wanting, but in other respects the animal was in good preservation.

The length was 3·2 cm., the height 1 cm., and the breadth of the dorsal surface 11 mm., of the foot 17 mm.; the breadth of that portion of the back which is beset with papillæ at most 3 mm. The height of the rhinophoria quite 6 mm.; the length of the tentacles 4 mm.; the height of the anal papilla 1·8 mm.; the length of the tail 5 mm.

The *colour* yellowish, but brownish or reddish along the middle line of the back; the region between the rhinophoria and the inter-rhinophorial "comb" is covered with a black spot, and the extremities of the rhinophoria are also blackish. The *form* of the body is somewhat short and depressed; the head flattened anteriorly, the mouth-opening perpendicular; the head is on every side produced into a rather narrow process, somewhat flattened below, which unites with the anterior edge of the foot and forms the upper lip of this anterior edge of the foot.[3] This wing-like process measures about 8 mm. in length, and is provided on its edge with a fine groove. The conical or finger-shaped *tentacles* take

[1] *Cf.* Bergh, Beitr. zur Kenntn. d. Æolidiaden I., *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien.*, Bd. xxiii., 1873, pp. 597–605, Taf. vii. figs. 1–6, Taf. viii. fig. 1.

[2] Alder and Hancock, Notice of a collect. of Nudibr. Moll. made in India, *Trans. Zool. Soc.*, vol. v. part 3, 1864, p. 141, pl. xxxiii. figs. 10–12.

[3] *Cf.* Bergh, *loc. cit.*, 1873, Taf. vii. fig. 1.

their origin from the lateral portions of the head; the *rhinophoria*, which are strong and conical, arise from the neck behind the anterior edge of the papilla-bearing dorsal wall; the stem is low, the club furnished (on either side) with about forty broad leaves (or laminæ). Between the rhinophoria is the slender somewhat depressed comb-like organ, which has a length of 2·5 mm. and a height of 0·8 mm., and which is divided into thick leaves by perpendicular furrows upon its edge which seem to be again divided. The eyes do not appear at the base of the rhinophoria. The *back* is somewhat broad, rounded at its anterior extremity, posteriorly it narrows, and ends in a sharp point. Its broad marginal portion, rather prominent at the edge, is covered with a dense mass of papillæ. In front this portion is somewhat narrower, and in the middle line that of either side is separated from the other by a narrow bare median space; at the posterior end the same conditions are repeated, but the median space is here narrower still. The papillæ appear to be arranged in a similar irregular fashion, as in the typical *Janus*. Only a few of the smaller papillæ were left, they appear to agree with those of the typical *Janus*. The anal papilla is situated on the dorsal median line, some way back (6 mm. from the end of the back); it is cylindrical in shape and truncated, with the folds of the intestine prolonged to the margin; it is directed backwards. The *sides* of the body are rather high at the middle, but diminished in height anteriorly and posteriorly. Rather backwards, corresponding with the anterior part of the pericardium, is the genital opening, surrounded by a horse-shoe shaped fold, and filled with the conically protruded end of the duct of the mucous gland, about 3·5 mm. high. Further back still, corresponding to the posterior end of the pericardium, is the conspicuous renal aperture. The *foot* is very large; in front it is straight, with a slight median notch, and with indications of a fine marginal furrow; as far as its slightly prominent corner, it is fused with the wings of the head already-mentioned. The foot stands out from the sides of the body, provided as it is with an undulating lateral brim about 3·5 mm. broad, which probably serves as an organ for swimming. The tail is broad and rounded at its posterior extremity; it has no sign of any keel.

The *pericardium* is the only part of the viscera that is visible through the walls of the body. The position of the viscera as in *Janus*.

The *central nervous system* (Pl. IX. fig. 6) is rather flattened and somewhat irregular; the cerebro-pleural ganglia (fig. 6, *ab.*) are rather elongated; an optic ganglion is present; the pedal and gastro-œsophageal ganglia resemble those of *Janus cristatus*. The eyes (fig. 6, *d,d.*) also resemble those of *Janus;* the outer end of the optic nerve is pigmented. At the base of the rhinophorion is the oval olfactory ganglion, which is somewhat larger than the buccal, and gives off a very stout and a thinner nerve. At the anterior margin of the club of the rhinophorion there are short leaves between the larger; the structure of the rhinophorion was quite typical.

The *mouth-tube* is about 1·3 mm. in length. The *bulbus pharyngeus* (Pl. VIII. fig. 15)

is enormously large, and measures 8·5 mm. in length, 10 mm. in height, and about 8 mm. in breadth. Its form is rather higher and shaped something like a helmet; the under surface is flat; the oblique anterior extremity of the body is narrow; the posterior extremity of the body, which is also oblique, is narrow above but considerably broader below; the sides of the body are divided into two halves, the anterior somewhat convex and the posterior concave, by a keel descending downwards and backwards. On the anterior margin, not far from the hinge (fig. 15, *b*) is the pharynx (fig. 15, *c*); the sheath of the radula is not at all conspicuous on the posterior surface. The structure of the *bulbus* is quite as usual. At the opening of the labial disk were visible the margins of the dark brown-coloured mandibles, closely approximated to each other.—The *mandibles* are far larger than those of any other Nudibranch. They are united to each other by a short, strong, tough, transverse band (above and below the small hinge). Each mandible was about 8·5 mm. long and 8·5 mm. in height; the thickness about the middle of its length was as much as 2·75 mm.; its colour a dull chitinous yellow, which changed on the lower part to a mahogany-brown, and on the antero-superior margin to a pale yellowish-white. The *outer* surface of the mandibles is convex, the inner a little concave; they meet anteriorly and posteriorly in a sharp edge; the inferior surface is very complicated. The outer surface (fig. 16) consists of two large facets, which slope anteriorly and posteriorly and meet in an oblique line or keel, which is directed downwards and backwards; this line becomes fused with the outer margin of the under surface; the hinder facette is in the upper part a little concave, or else very slightly convex. The somewhat convex antero-superior marginal part is separated from the anterior facette and from the upper edge of the mandible by a furrow, and as already mentioned is of a yellowish-white colour; the facette itself is somewhat arched; from its under surface (figs. 16, *a*, 17, *a*) is given off a powerful ridge (lying on the outer side of the hinge and serving for the attachment of muscles and the ligament); the ridge of the right mandible is stronger than that of the left. The *inner* surface is concave from above downwards (fig. 17), somewhat arched from before backwards; the upper marginal portion already mentioned is quite plain on this side; the inner lamella of the under surface is fastened to the antero-inferior portion of this side. The excavated *lower* surface (fig. 18) is continued obliquely forwards and inwards into a short stout process (processus connectivus), which is of the same dark colour as the rest of the under surface, and is cut short at the extremity. The strong outer lip of this surface is depressed, posteriorly it diminishes in height and runs in a straight course; the convex inner and outer surfaces of the lip are continued into the smooth, rounded, masticatory edge. The inner lip is stronger, shorter, more prominent downwards and shield-shaped (fig. 17, *b*) when seen from the inner side of the mandible, but somewhat flattened in the middle; the lower margin thin, smooth. From the anterior part of the inner lip a convex partition wall (fig. 18) extends downwards obliquely to the anterior part of the

outer lip. In front of this septum, and between both the lips, there exists a triangular groove deep in front (fig. 16); above the septum also there is a deep, nearly funnel-shaped cavity, the upper wall of which is formed from the anterior end of the under side of the substance of the mandible; the inner margin is here much more prominent (fig. 16). Transverse sections of the jaws show the colour of the main portion to be a pale, clear, chitinous yellow, only a thin layer on the under side and adjoining part was of a chestnut brown.—The large mass of muscles (fig. 19 *d*) (5·5 mm. broad posteriorly), which lies between the hinder margin of the jaws, is made up of thick horizontal transverse fascicles, quite distinct from each other; the function of these muscles is to divaricate the mandibles. The narrow *mouth-cavity* lies between the huge mandibles; it increases slightly in width in its course backwards and downwards, where it is entirely filled up by the tongue (fig. 19 *a*). The *tongue* is strongly compressed; it is short and keel-shaped, and has a length of 2·25 mm., and a height of 2 mm.; the anterior and upper margin is traversed by a deep groove; the muscular mass belonging to this tongue is also compressed, and is 3·5 mm. in length by 3 mm. in height, and 2 mm. in thickness at the cleft hinder end, lying in front of the mandibular muscles. The broad *radula* extends beyond the end of the tongue; there are sixteen series of pale yellow-coloured teeth; beneath the strong *tectum radulæ* (fig. 19 *b*), and within the radula sheath, which is dilated into an ampulla (fig. 19 *c*) posteriorly, are six developed and two not fully developed series; the total number therefore is twenty-four. In the eleventh series there are thirty lateral teeth on either side of the median tooth; within the foremost part of the sheath there are fifty-four, but the number does not appear to increase farther back. The plates were of a yellowish colour. The length of the lateral teeth of the radula reaches ·28 mm., with a height of ·05 mm.; the length of the next outermost tooth is ·12 mm., while the outermost one measures only ·1 mm. in length, the first being ·03, and the second ·025 mm. in height. The length of the coloured portion of the median tooth is from ·08 to ·1 mm., by a breadth of ·02 and a height about the same. The median teeth (Pl. VIII. fig. 20 *a*, Pl. IX. 7 *a*) are narrow, and only coloured in about their posterior third; farther forwards they are rather higher; the apex of the low, slightly bent hook reaches beyond the base (fig. 20 *a*). The lateral teeth also are narrow and slender (figs. 20 *b*, 7, 8), and somewhat bent; the basal portion is cut short in front, but rounded behind; the hook short but well developed; the yellow-coloured part of the teeth is continued anteriorly into a colourless cuticula (fig. 20 *c*, 7, 8). The innermost lateral tooth is the longest (figs. 20 *b*, 7 *c*). The length of the teeth diminishes gradually as we pass outwards, and somewhat more quickly in the outmost part (fig. 22, 8 *a*). Occasionally irregularities may be observed in the form of the teeth (fig. 21).

The *salivary glands* are slightly separated from each other; they are attached to the anterior margin and under surface of the stomach; the colour is brownish-grey. The œsophagus (Pl. VIII. fig. 15 *c*) is short. The *stomach* closely resembles that of the

genus *Janus*, and lies transversely; its length is about 7 mm., and its breadth 3·5 mm; on either side it receives the long yellowish-brown-coloured bile duct; near the left bile duct open the wider main bile-duct, which runs medially along the under surface of the hermaphrodite gland; the hinder pyloric end of the stomach has a thicker darker brown-coloured wall. The *intestine* resembles that of *Janus*.[1] The posterior bile duct as well as the intestine, when opened, was found to contain a mass of soft yellowish calcareous and animal débris, the nature of which could not be recognised. The *liver* is probably like that of *Janus*, but I am unable to say anything with certainty about the liver-cæca in the papillæ.

The heart and the renal system appear not to differ from those of *Janus*.

The *hermaphrodite gland* is of a beautiful reddish-yellow-ochre colour, and is of a short conical shape, with a slanting broad base and a slightly flattened rounded posterior end, its length is 11 mm., and its breadth 10 mm. The gland is made up of a small anterior right-hand, and a larger posterior left-hand portion; both these portions are composed of a great number of rounded, facetted, and finely granular lobules, measuring 2·25 mm. in diameter. The gland is acinous in structure; in the ovarian follicles are the large oogene cells. The *hermaphrodite duct* lies deep down between the two halves of which the gland is composed, and is formed from two main branches; the colour is whitish; in front of the hermaphrodite gland it forms a delicate coiled *ampulla*, 2 cm. long and ·5 mm. broad, which about the middle of the upper side of the *anterior genital mass* opens into it. This latter organ is about 11 mm. long, 7·5 mm. broad, 7 mm. high; the under surface is convex, the margins of the sides quite parallel; the upper surface, on account of the presence of the penis and the coiled knot formed by the vas deferens, decreases in size from the middle towards the anterior and posterior margins respectively. The *vas deferens* is yellowish in colour and coiled into a large roll; when uncoiled, its length is about 6 cm. and its diameter through its whole length ·3 mm.; it passes into the much thicker *penis*. This last, or to speak accurately the præputium, is 5 mm. long and 4 mm. in diameter, and is entirely occupied by the glans. The glans consists of a cylindrical portion and a broad horizontal piece forming its anterior third. I was able to trace out the vas deferens to its circular opening on one of the corners of the transverse piece of the glans; its diameter is uniform throughout its whole course. There is no armature either on the glans or in the vas deferens. The short sac-like seminal bladder has a length of 2·25 mm., it was filled with semen; its duct is about as long as the organ itself. The *albuminiparous gland* is yellowish, the slime-gland whitish; the duct has the usual fold.

Cuthonella, n. gen.

Corpus elongatum vix depressum. Caput sat latum, tentaculis vix longis, rhinophoriis simplicibus. Anus latero-dorsalis. Papillæ conicæ, vix caducæ, seriebus transversalibus, coetibus paucis aggregatis positis. Podarium sat latum, antice angulatum.

[1] The state of preservation of this part of the body permitted no sufficient investigation into the alimentary tract.

Mandibulæ sat breves, margo masticatorius seriebus denticulorum compluribus armatus. Dentes linguales uniseriati, cuspide prominenti, utrinque denticulati.—Penis inermis.

This novel form, for which I have established the generic name *Cuthonella*, somewhat resembles *Cratena*[1] and *Cuthona*,[2] but differs in some comparatively essential points. The anus, instead of being situated upon the side of the body, is dorsal and slightly lateral. The dorsal papillæ are not inflated; they are set in transverse or oblique rows, which are crowded together so as to form a few larger groups. In the specimen that I examined the cnidophorous bags were absent. The foot is not very broad, its anterior margin is truncated.—The mandibles are somewhat short, the masticatory edge provided with several series of strong denticles. The radula has a single series of largish teeth, with a denticulate cutting edge. The penis is unarmed.

The genus hitherto contains only one species.

Cuthonella abyssicola, n. sp. (Pl. X. figs. 1–3; Pl. XI. fig. 2; Pl. XII. figs. 9–13).

Habitat.—North Atlantic.

One specimen was taken by Mr. John Murray with the trawl, on August 23, 1882, in the Faröe Channel, lat. 60° 5′ N., long. 6° 21′ W.; in the cold area, from a depth of 608 fathoms; bottom temperature 30° Fahr.

The specimen had been preserved in alcohol and was somewhat contracted; the total length was 2·5 cm., the breadth 6 mm., and the height 6 mm.; the length of the tentacles 2·5 mm., of the rhinophoria 5 mm., and of the dorsal papillæ as much as 7 mm.; the breadth of the anterior portion of the foot 8 mm., the length of the tail 2·5 mm. The colour of the animal is of a uniform dirty-yellow, with the exception of the papillæ, which are of a light brownish-grey but yellowish at the tip. The intestines are not visible through the walls of the body.

The body is stout and elongated. The head rather flat, the tentacles short; the longer rhinophoria wrinkled; the mouth-aperture is vertically elongated, and forms a perpendicular slit. The foot is large, with a truncated anterior portion; the free edge of the foot projects about 1·75 to 2 mm. beyond the sides of the body; on the anterior margin of the foot is a furrow; the tail is rather short. The genital papilla is situated on the right side below the anterior half of the first group of papillæ, and consists of a prominence with the projecting glans (Pl. XII. fig. 10), behind which are two apertures placed upon a slightly excavated area (fig. 10). The median portion of the dorsal surface, which is free from papillæ, is in the anterior half about as wide as the lateral papilla-bearing portions. The

[1] R. Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft i., 1876, pp. 9–12, Tab. iv. figs. 1–15.

[2] R. Bergh, Beitr. zur Kenntn. d. Moll. des Sargassomeeres, *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, Bd. xxi., 1871, pp. 1280–1283.

papillæ are arranged in four groups on either side, but the arrangement is not so distinct as in other Nudibranchs. The first two groups are the largest and about equal in size; the two others smaller but corresponding with each other in size. Each group is made up of a number of short transverse or oblique rows, occasionally horse-shoe-shaped (Pl. XII. fig. 9, *c*); there are two to four, or sometimes as many as five or six, papillæ in each row. Altogether the first group contained about thirty papillæ, the second thirty to thirty-five, the third twenty-one to twenty-five, the fourth eighteen to twenty. The papillæ are conical in form, somewhat constricted at the base, and firmly attached to the skin; those on the outer side were nearly always much smaller than those on the inner side. The anal papilla is rather prominent (Pl. XII. fig. 9, *a*), and is situated on the right side of the body, on a level with the anterior end of the second group of papillæ. In front of it is the small triangular renal pore (fig. 9, *b*).

The central nervous system consists of a pair of somewhat flattened oval cerebro-pleural ganglia; the pedal ganglia are of about the same size as the cerebro-pleural; the subcerebro-pedal commissure is about equal in length to the longest diameter of one of the pedal ganglia; the visceral commissure is of about the same length. The olfactory ganglia at the root of the rhinophoria are rounded in shape; the oval buccal ganglia are of about equal size with the olfactory, the commissure uniting the two buccal ganglia is about as large as the ganglion itself; the gastro-œsophageal ganglia are provided with a short stalk, they are round in shape and contain one very large and several smaller cells, their size being about one-third of the buccal. The *eye* has a short stalk, the lens is yellowish, and the pigment deep black. The *otocyst* is a trifle larger than the eye, and has a very short stalk; it contains a number of rounded and not very strongly calcified otoconia.

The *bulbus pharyngeus* is strong and resembles that of the Æolidiadæ proper; it is about 4 mm. in length, 3·5 mm. in breadth, and 3·2 mm. in height; the sheath of the radula projects backwards, the labial disk is typical. The *mandibles* are strong and convex, of a chitinous-yellow colour; the hinge part is small, the simple *crista connectiva* narrow; the masticatory process (Pl. X. fig. 1) is short; its edge is provided with several series of somewhat compressed rounded teeth ·03 mm. in height (Pl. XI. fig. 2). The accessory buccal cavities are rather large (Pl. X. fig. 1, *c*). The *tongue* is strong and somewhat compressed, and has thirteen series of teeth; further back within the radula sheath are six developed and two undeveloped series, the total number being thus twenty-one. The colour of the teeth is chestnut yellow, the height of the anterior ones is ·1 mm., and passing backwards increases to about ·14 mm.; the breadth of the youngest teeth is about ·3 mm.; the form of the teeth (Pl. XII. figs. 11–13) is somewhat clumsy; on each side of the pointed apex are from ten to twelve denticles, which are often hook-shaped. The *salivary glands* are rather small and elongated, whitish in colour; the efferent ducts rather long.

The *œsophagus* is short and rather narrow, its length is 5·5 mm. The *stomach*

receives posteriorly the strong bile duct of the first group of papillæ; along its upper wall a strong fold runs from the cardiac to the pyloric end. The large main bile duct, which receives three or four smaller ducts on each side, runs through the hermaphrodite gland, in a groove on its lower surface; the duct, receiving 3–4 lateral bile ducts, enters the stomach close to its junction with the intestine. The course of the latter is downwards and then upwards to the anal papilla, the total length 6 mm.; its inner surface has numerous fine longitudinal folds, which decrease in number, but become stouter as the intestine passes backwards. The alimentary tract throughout its whole extent contained a quantity of animal matter, the nature of which I was not able to determine; it was full of variously sized cnidæ. The hepatic lobes are conical in form, but not quite equal in size; the upper surface occasionally showed granulations. No trace of any cnidophorous sacs [1] could be detected, but a pore was sometimes visible upon the summit of the larger papillæ.—The *pericardium* was quite typical; the ventricle of the heart about 1·75 mm. long. The *renal syrinx* pyriform in shape, 1·3 mm. long; the ureter about the same length as the latter; I succeeded in tracing it as far as the renal pore.

The hermaphrodite gland is long, the lobes large and irregular, composed of a number of smaller lobules; the rounded testicular parts are covered nearly all over with the white or yellow ovarian follicles; the gonoblasts are developed.—The anterior genital mass is about 6 mm. long by 4 in breadth, and 4·5 mm. in height. The ampulla of the hermaphrodite duct is elongated and sac-shaped, and curved in the middle; when straightened out it measures 4 mm. in length by about 1 mm. in diameter, and is of the usual opaque yellowish-grey colour. The *ductus ejaculatorius* (Pl. X. fig. 2, *aa*) is strong and coiled; when uncoiled it measures about 8 mm. long; it is somewhat thinner in the anterior third. The penis is much thicker, the præputium (fig. 2 *cc*) has rather thick walls. The glans is conical, about 2 mm. long, its anterior half freely projecting (Pl. X. fig. 2, *de*; Pl. XII. fig. 10). Into the ductus ejaculatorius opens another (Pl. X. fig. 2, *b*) somewhat thinner duct, which probably arises from some gland. The glans and the termination of the seminal duct are quite unarmed. The spermatheca (Pl. X. fig. 3, *a*) is oval in form; it was quite empty in the specimen which I examined; the duct is nearly twice as long as the organ (fig. 3, *bc*). The mucous gland is whitish, its cavity rather large; the albuminiparous gland rather more yellowish.

Between the *bulbus pharyngeus* and the anterior genital mass was found the female of an animal in form very like *Splanchnotrophus;* [2] another was imbedded in the superior face of the hermaphrodite gland; both individuals were about 5 to 6 mm. in length. No males were detected. [3]

[1] In the doubtful species *Cratena lugubris* (Bergh, Malacolog. Untersuch., *loc. cit.*, Heft i., 1876, pp. 9–12, Taf. iv. figs. 1–15) no cnidophorous sacs were found.

[2] The animals were too much hardened to allow of any thorough examination; it was impossible to examine properly the anterior genital mass.

[3] In *Homoiodoris japonica* I found both male and female individuals resembling *Splanchnotrophus*. *Cf.* Bergh, Beitr. z. Kenntn. d. japan. Nudibr. II., *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien.*, Bd. xxxi., 1881, p. 226, Note.

Rizzolia, Trinchese.

Rizzolia, S. Trinchese, Rendic. dell' Accad. di Bologna, 1879–80, p. 62.
„ R. Bergh, Beitr. z. Kenntn. d. japan. Nudibr. I., Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxx., 1880, pp. 156–160.
„ R. Bergh, Beitr. z. Kenntn. d. Æolidiaden, VII., *loc. cit.*, Bd. xxxii. 1882, pp. 37, 38.

Corpus gracilius elongatum; rhinophoria simplicia; tentacula elongata; papillæ (dorsales) non caducæ pedamentis humilibus impositæ; podarium antice angulis tentaculatim productis.

Margo masticatorius mandibularum serie denticulorum grossiorum. Radula paucidentata; dentibus uniseriatis, cuspidatis, denticulatis.

Penis inermis.

The genus *Rizzolia* was established by Trinchese in 1877. In external characters it closely resembles *Facelina*, but is readily distinguished by the rhinophoria, which are plain (not perfoliated), and by the unarmed condition of the penis.

Only the following species of the genus are known :—

1. *Rizzolia peregrina* (Gmelin).
Mediterranean.

2. *Rizzolia modesta*, Bergh.
Japanese Sea.

3. *Rizzolia australis*, n. sp.
Pacific Ocean.

Rizzolia australis, n. sp. (Pl. IX. figs. 1–5).

Habitat.—Pacific (Port Jackson).

A single specimen was dredged, together with *Chromodoris runcinata*, from a depth of 2 to 10 fathoms, in Port Jackson, on the 17th April 1874. It was strongly hardened through having been preserved in alcohol, and had lost its dorsal papillæ.

The specimen measured 18 mm. long, by a breadth and height of about 4 mm.; the height of the tentacles was 3·5 mm., of the rhinophoria 3 mm., and the length of the edges of the foot 1·7 mm.; the breadth of the sole of the foot was for the most part 2 mm.; anteriorly it was somewhat larger, posteriorly somewhat narrower; the length of the tail quite 4 mm. The *colour* throughout was of a yellowish-white, the anterior margin of the head was whitish, and from it a slender, whiter median line, discontinuous here and there, extended along the back; in front of and behind the rhinophoria there was a small transverse

band; on the posterior half of the back, below on the side of the body, and on the edge of the foot, there were a number of small partly white rounded oval spots, regularly arranged; the margin of the foot is whitish; the hepatic cæca are visible through the walls of the papillæ, and are brown or black.

The shape of the body is slender, like that of other specimens of the genus. The mouth-tube was invaginated; the strongly developed *tentacles* are sharply marked off from the rest of the head; the *rhinophoria* are cylindrical in shape and provided with about fifteen rings, and here and there half rings lying between the others. The naked part of the *back* is about double the breadth of the portions covered with papillæ; the breadth of the back decreases towards the hinder end, but the relation between the portions of the back covered with papillæ and the uncovered portion remains the same. On the lateral portions of the back the papillæ are arranged in six low horse-shoe-shaped cushions, and further back there are three isolated rows. The size of the cushions themselves, and of the intervals between them, decreases from before backwards. The anterior leg of the first 4–5 horse-shoes is stronger. The *first* horse-shoe-shaped group of papillæ has the anterior portion much thicker, and provided with about eight series of papillæ; the hindermost has only two rows. The *second* group is smaller, but the anterior portion of it is in the same way thicker, and has five or six rows of papillæ, the posterior portion only having two. At the upper end of the corner of this horse-shoe is the somewhat conspicuous anal papilla inclining towards the posterior leg. The renal aperture is more anterior, and a little lower down. The third, fourth, and fifth "horse-shoes" have each three to two rows of papillæ; on the hindermost there are sometimes only two rows or one. Most of the papillæ had fallen off, and only some of the smaller ones were preserved; they were club-shaped, with a pointed upper end. The *sides of the body* are high in front, decreasing gradually behind. The double *genital papilla* is situated near the anterior end of the first (right hand) group of papillæ. The *foot* is strong, broader in front, with a marginal furrow; posteriorly it gradually decreases in size; its free lateral margin is rather small; the tail is provided with a strong dorsal keel.

The intestines are visible through the body wall, especially on the back, less so at the sides of the body.

The cerebro-pleural *ganglia*[1] are somewhat quadrangular in shape and flattened, united with each other by a short commissure behind the middle of the ganglion; the line of division between the two component ganglia (cerebral and pleural) is very evident, the cerebral being a little the larger. The pedal ganglia are rather larger than the cerebral, somewhat compressed from before backwards, extending out from the infero-anterior portion of the underside of the former ganglia. The strong commissure is as long as the diameter of both cerebro-pleural ganglia; not far from either end the commissure

[1] This agrees with the nomenclature used by Spengel in his excellent memoir, Ueber die Geruchsorgane und Nervensystem der Mollusken, *Zeitschr. f. wiss. Zool.*, Bd. xxxv., 1881, p. 234.

gives off a strong branch; the special commissures making up the united commissural band could not be separated from each other. The spherical olfactory ganglion is situated in or at the root of the rhinophore, and is somewhat smaller than the buccal ganglion. The buccal ganglia are of oval contour, united by a commissure, which is about equal to half the ganglion in diameter; the gastro-œsophageal ganglion has a short stalk, its size is not more than one-sixth of that of the buccal ganglion.

The *eyes* are situated on the shallow excavation of the outer edge of the cerebro-pleural ganglia; the optic nerve is about as long as the diameter of the eye; the pigment is black, the lens yellowish. The *otolithic vesicles* are situated just behind the eyes, and are a little smaller than them in size; they contain some sixty otoconia of the normal form.

The *bulbus pharyngeus* (which was half projecting) is of the typical form, 5 mm. long, 3·5 mm. broad, and 2·5 mm. high; the radula-sheath projects slightly at the hinder end below; the labial disk is roundish, the boundary of the spacious accessory-buccal cavities is clearly visible through the walls of the bulbus. The *mandibles* are of a clear yellow colour, strongly arched; the anterior part of the upper margin is bent inwards, and forms a small horizontal surface, which is bounded by a keel, which, higher in front, extends as far as the crista connectiva; the hinge is small; the crista connectiva has a longitudinal furrow, which is not identical on both the jaws; the bent masticatory process is short and somewhat strong; the upper portion is quite smooth (worn out?); the rest was provided with about forty denticles, reaching, on the outer side, a height of ·06 mm. The denticles (Pl. IX. fig. 1) are divided by an oblique slit at the top, the inner part is conical, more or less bent, the outer part rather wing-shaped. The *tongue* has a clear yellow radula, with six plates on the under margin and four on the shorter upper margin, further backwards there were thirteen developed and two undeveloped teeth; the total number is therefore twenty-five. The teeth are chitinous yellow in colour, the breadth of the youngest (hindmost) ·26 mm., the height ·28 mm.; these teeth (figs. 2–5) show a rather long slender hook and four, occasionally three (fig. 3), strong denticles of the cutting edge of which the one beneath is generally the smallest.

The white *salivary glands* are 1·5 mm. long and ribband-shaped, posteriorly they are a little broader and lobate on the margin; the salivary ducts are not very short.

The *œsophagus* is short; the *stomach* rather large with a short oval contour; from either side two bile ducts arise from the two anterior groups of papillæ, at the hinder end is the main bile duct; the latter opens close to the pylorus; the inner surface is furnished with strong folds, which radiate out from the cardiac end. The main bile-duct is somewhat wider than the gut, running along the middle of the length of the dorsal surface of the hermaphrodite gland, receiving a bile-duct from each group of papillæ commencing with the third, and reaching behind the hermaphrodite gland. The gut is wide, its course

posteriorly is first downwards then upwards; it is covered at the middle by a large lobe of the hermaphrodite gland; when stretched, the gut measured 11 mm. in length and ·75 mm. in diameter. The inner surface has longitudinal folds, one of which is especially developed. The cavity of the gut contained a quantity of unrecognisable animal matter.

The lobes of the *liver*, within the papillæ, are tuberous; the almost spherical cnidophorous sacs are united to them by a short ligament; they were full of cnidæ of oval shape, and measuring from ·005 to ·007 mm.

The pericardium and the contained heart were typical, and also the yellowish-white *renal syrinx* situated in the neighbourhood of the renal pore.

The yellowish *hermaphrodite gland* has a length of 7 mm. and a breadth and height of about 3·5 mm.; it is conical in shape; along the dorsal surface there is a wide and deep furrow for the main hepatic duct; the gland shows traces of division into halves, each composed of a considerable number of lobes, which are themselves divided into smaller lobules. The lobules have the usual structure, and the testicular portion, which is white in colour, is easily distinguished from the yellow ovarian follicles. The somewhat thick *hermaphrodite duct* which takes its rise from the hollowed-out anterior part of the gland, is white in colour, and of inconsiderable length, gradually passing into the ampulla.—The *anterior genital mass* is large, 5·5 mm. long, 4 mm. broad, and 3·5 mm. high; about the middle of the upper surface there is a square saddle-shaped hollow for the stomach. The opaque whitish-yellow *ampulla* of the hermaphrodite duct is about five times the thickness of the duct itself; it forms the posterior end of the genital mass, and is coiled upon itself; when unrolled it measures about 12 mm. long, by ·8 mm. in diameter. The male branch immediately becomes the coiled *vas deferens*; this is very thick walled and white in colour, when unrolled measuring some 13 mm. in length and ·6 mm. in diameter throughout its whole extent; it passes above into the excavated base of the (invaginated) *penis*. The penis is short and sac-like, about 2·5 mm. in length, yellowish-white in colour; the cavity of the præputium is almost entirely filled by the strongly developed conical yellowish glans, which is entirely unarmed. The *vesicula seminalis* is spherical. The *mucous gland* shows many coils, and is chalk-white; the *albuminiparous gland* is dirty yellow.

There is hardly any doubt that this species is a *Rizzolia*; since it agrees so closely with that genus in the character of the mandibles, in the armature of the tongue, and the structure of the penis; the ringed form of the rhinophoria is probably merely dependent upon contraction. The peculiar structure of the denticles of the mandibular process will perhaps render this species easier of recognition.

Scyllæa, Linné.

Scyllæa, Linné, Syst. Nat., ed. x., 1758, vol. i. pp. 644, 656.
„ Cuvier, Ann. du Mus., t. vi., 1805, p. 416, pl. xix.
„ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft viii. 1875, pp. 315–343.
„ Bergh, Beitr. z. Kenntn. d. Moll. des Sargassomeeres, Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxi., 1871, pp. 1288–1293.
„ Bergh, Beitr. z. Kenntn. d. japan. Nudibr. I., *loc. cit.*, Bd. xxx., 1880, pp. 166–172.

Corpus oblongum, compressum. Tentacula propria nulla; rhinophoria compressa, auriformia, supra calyculata cum clavo parvo perfoliato. Dorsum angustum; utrinque papillis duabus foliaceis ut plurimum repandis, pagina interna arbusculis branchialibus præditis; postice cum crista (caudali) elevata, utroque latere arbusculis branchialibus instructa. Podarium angustum, antice rotundatum.

Mandibulæ applanatæ, processu masticatorio magno margine minute tuberculato. Lingua lata; rhachide dente utrinque denticulato; pleuris multidentatis, dentibus utrinque sed inæqualiter denticulatis. Ventriculus lamellis masticatoriis armatus. Glandulæ hermaphrodisiacæ (1–3) discretæ. Penis inermis.

These animals have been known from the time of Seba (1734) and Linné, but these two authors described them erroneously, mistaking the upper for the under side. Although this error was corrected by Osbeck (1757), and by Forskål (1775), the nature and systematic position of the genus was doubtful until the time of Cuvier (1798, 1805). Recently the genus has become better known through my three Memoirs just cited (1871–1880).

The external appearance of *Scyllæa* is remarkable, and it is at once distinguishable from any other known genus by the character of the rhinophoria and of the large dorsal foliaceous papillæ, and by the caudal crest covered like the inside of the papillæ with branchial tufts.—The structure of the mandibles and radula is also peculiar; a masticatory stomach is present. The hermaphrodite gland is divided into three distinct lobes; the penis, as in allied genera, is unarmed.

Scyllæa inhabits the tropical and subtropical portions of the ocean; it feeds upon Hydroids (especially Campanulariaceæ), and is found creeping over the surface of Fucoids in search of its food; but it also swims about in the sea. The spawn of the typical form has been seen.

Several species have been described, or at least named, some of which will no doubt eventually prove to belong to one circumæquatorial species.

The following is a list of these species:—

1. *Scyllæa pelagica*, Linné.
Atlantic Ocean.

Scyllæa pelagica, var. *marginata*, Bergh.

? *Scyllæa grayæ*, Adams.

Atlantic Ocean.

Scyllæa pelagica, var. *ghomfodensis* (Forskål).

Red Sea.

Scyllæa pelagica, var. *sinensis*, Bergh.

Chinese Sea.

Scyllæa pelagica, var. *orientalis*, Bergh.

? *Scyllæa ghomfodensis*, Quoy et Gaimard.

Philippine Sea.

2. *Scyllæa fulva*, Quoy et Gaimard.

Pacific Ocean.

3. *Scyllæa marmorata*, Alder and Hancock.

Indian Ocean.

4. *Scyllæa quoyii*, Gray.

Indian Ocean.

5. *Scyllæa elegantula*, Bergh.

Philippine Sea.

6. *Scyllæa viridis*, Alder and Hancock.

Indian Ocean.

7. *Scyllæa bicolor*, Bergh.

Japanese Sea.

8. *Scyllæa hookeri*, Gray.

Pacific Ocean

9. *Scyllæa edwardsii*, Verrill.

Scyllæa edwardsii, Verrill, Amer. Journ. Sci. and Arts, vol. xvi., 1878, p. 211.
„ „ „ Catal. of Marine Moll., Trans. Connect. Acad., vol. v., part 2, 1882, p. 550.

Atlantic Ocean.

SCANNED

Scyllæa pelagica, Linné (Pl. XI. fig. 20).

Scyllæa pelagica, L., Bergh, Beitr. z. Kenntn. d. Moll. des Sargassomeeres, *loc. cit.*, pp. 1288–1293.

„ „ L., Bergh, Malacolog. Untersuch., *loc. cit.*, pp. 319–334, Taf. xl., xlii., xliii. figs. 1–6.

Five specimens were taken in the Atlantic, on the surface, attached to a Fucoid, May 4th and 5th, 1876.

The larger individual measured 3·5 cm. in length, by 1·2 cm. in height, and ·75 cm. in breadth. The height of the rhinophoria was 5·5 mm., of the first pair of dorsal papillæ 7·5 mm., of the second 7 mm., of the caudal crest 5·5 mm. The colour of the animal is a dirty yellowish-white.

The *form* of the body was quite as usual, and also the *head* and *rhinophoria*; the club of the latter was provided with about seven leaves. The branchiæ were grouped in the following way. Nine or ten more or less distinctly separated tufts were situated on the inside of the first pair of papillæ; thirteen or fourteen rather smaller branchiæ on the inside of the second pair, and on the sides of the caudal crest were four to five small branchial tufts, and in addition a few small tufts were found in the neighbourhood of the interpapillary margin. The anal and genital papilla together with the renal pore were perfectly typical, as also the foot.

The visceral cavity extends about as far as the anterior end of the caudal crest.

The *central nervous system* presented a commissure no longer than in the example already figured by me;[1] in no other specimen did I ever see it much longer; the three portions of which the commissure is made up were easily to be distinguished; the subcerebral commissure appears never to be distinct.[2] The eyes and otocysts were as usual.

The *bulbus pharyngeus* is about 4·6 mm. long, and of the usual form; the *mandibles* have already been described by me as well as the peculiar armature of the masticatory edge which can easily be rubbed off, thus leaving the jaw smooth. The *tongue* presents its usual appearance, the radula containing seven series of teeth and sixteen series within the sheath, the total being therefore twenty-three rows. In the posterior row of the tongue there are thirty-six lateral teeth (on either side of the median tooth); thirty-nine in the posterior row of those within the sheath. The form of the teeth presented no peculiarities. The salivary glands were quite typical.

The *œsophagus* and anterior division of the *stomach* were typical, the second division possessed fourteen strong plates; the characters of the intestine and *liver*, with its two divisions and the ramified hepatic tubes were as already described by me. The *renal system* presented no deviations from the structure which has been described by Hancock and myself.

[1] Malacolog. Untersuch., *loc. cit.*, Taf. xl. figs. (13), 14.

[2] H. v. Jhering describes the commissures as much longer and the subcerebral as distinct. Vergl. Anat. d. Nervensyst. d. Moll., 1877, p. 176.

The *hermaphrodite gland* is made up of six distinct lobes; three are situated posteriorly (the hindermost is somewhat larger than the other two), two median lobes are situated under the posterior liver, and an anterior just at the hinder end of the *anterior genital mass*. This last large one measures about 7 mm.; the ampulla of the hermaphrodite duct is dirty yellow, somewhat sausage-shaped, it is bent upon itself, and when straight it measures about 15 mm.; the penis is conical, about 2·5 mm. long, the glans nearly fills the præputium (Pl. XI. fig. 20, *b*); the spermatheca is of the usual small size; the mucous gland is whitish, the albuminiparous gland brownish in colour.

Bornella, Gray.

Bornella, Gray, Figures of molluscous animals, vol. iv., 1850, p. 107.
„ „ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft vii., 1874, p. 287–308, Taf. xxxvi.–xxxviii.

Corpus compressum. Tentacula breve pedicellata, e conis vel cylindris humilibus seriebus curvatis dispositis formata. Rhinophoria papillis dorsalibus anticis quasi connata; vagina rhinophorialis margine digitato, clavus perfoliatus. Margo dorsalis utrinque papillis fortioribus, apice digitatis, infra branchiferis continuatus; branchiæ compositæ, externæ et internæ, externæ sæpius appendicibus simplicibus defensæ. Anus latero-dorsalis. Podarium angustius, antice rotundatum.

Armatura labialis peculiaris, quasi squamosa. Mandibulæ fortiores, compressæ. Radula dentibus medianis fortioribus, margine lævi vel denticulato; dentibus lateralibus compluribus corpore elongato, hamo obliquo, elongato, margine lævi.—Ventriculus secundus spinis seriatis armatus. Penis annulo spinarum armatus.

The genus *Bornella* was created by Gray in 1850, from a specimen brought back by H. and A. Adams, who accompanied the expedition of the "Samarang," or perhaps from the figure of the animal given by these authors.[1] About the same time (1848 or 1850) the genus was a little more fully described by Adams and Reeve,[2] the description in "Gray's Guide" being indeed hardly sufficient for recognition of the animal. Hancock (1864, 1866) made considerable addition to our knowledge of this genus which a few years later (1874) was described by me in detail in my monograph.

These animals agree in their outward form with the Dendronotidæ, being, like them, compressed. At the front are the peculiar *tentacles* which are provided with a short stalk; this has a number of short conical or cylindrical projections arranged in two rows. The *rhinophoria* are fused throughout their whole length with a process which extends beyond them, and is like one of the dorsal papillæ. The sheath of the rhinophorium is divided above into finger-shaped branches; the club being strongly perfoliated.

[1] Bergh, *loc. cit.*, p. 287, notes 2, 3.
[2] Bergh, *loc. cit.*, p. 287, note 3.

The *dorsal margin* is prolonged into several *papillæ*, which at the free upper end are divided into several (4–2) points, and at the base bear several tripinnate *branchiæ*, which on the outer side are sometimes protected by special finger-shaped processes. The *anus* is latero-dorsal in position, and lies just in front of the second dorsal papilla. The *foot* is small and rounded anteriorly.

The *bulbus pharyngeus* is not large, and is to a great extent formed by a powerful muscular mass as in the Pleurophyllidiadæ and Phylliroidæ. The thick *labial disk* has a special scale-like armature. The *mandibles* are large, powerful and compressed, without any masticatory process. The *tongue* is high; its armature consists of a median tooth, which is not large, and number of lateral teeth, the latter being always smooth, the former occasionally denticulate. The *stomach* has two divisions, *the hinder of which is provided with a series of chitinous spines* in its interior. The gut is short. With the exception of one form (*Bornella excepta*), all the species of this genus which have been hitherto examined possess a branched liver which sends prolongations into most of the papillæ, entering them more or less at the base. The *penis* has an oblique girdle of straight or curved *thorny processes*.

The genus *Bornella* seems to be confined to the tropics, and has always been found among Fucoids; of its habits Adams and Pease have given some account; the animals are said to creep "briskly" about over the surface of Fucoids; and sometimes to swim freely in the water by lateral movements of the body.

Only the following species[1] have been hitherto described:—

1. *Bornella digitata* (Adams and Reeve), Bergh.
   Indian Ocean.

2. *Bornella calcarata* (Mörch), Bergh.
   Atlantic Ocean.

3. *Bornella arborescens* (Pease), Bergh.
   Bergh, Neue Nacktschnecken d. Südsee. II. Journ. d. Mus. Godeffroy, Heft vi., 1874, pp. 96–102, Taf. i. figs. 3–4; Taf. ii. figs. 30–33; Taf. iv. figs. 1–28.

4. *Bornella excepta*, n. sp.
   Pacific Ocean.

5. *Bornella adamsii*, Gray?
   Indian Ocean.

6. *Bornella hancockana*, Kelaart?
   Indian Ocean.

[1] Bergh, *loc. cit.*, pp. 288–289.

7. *Bornella hermanni*, Angas ?

Journ. de Conchyl., sér. 3, t. iv., 1864, p. 61, pl. vi. fig. 1.

Pacific Ocean.

8. *Bornella semperi*, Crosse ?[1]

Bergh, Malacolog. Untersuch., *loc. cit.*, Heft. i., 1870, Taf. i. figs. 3–5.

Philippine Sea.

9. *Bornella caledonica*, Crosse ?

Journ. de Conchyl., sér. 3, t. xv., 1875, p. 318, pl. xii. fig. 10.

Pacific Ocean.

Bornella excepta, n. sp. (Pl. VII. figs. 13–22; Pl. VIII. figs. 1–13).

Color animalis ?

Rhinophoria basi non appendiculata, parte posteriori (papillari) apice quadrifida; papillæ dorsales utrinque 5, infra branchiferæ, apice bi- vel tri-fidæ; branchiæ externæ, appendiculatæ, internæ sine appendice.

Dentes (linguæ) mediani margine denticulato. Hamuli penis erecti.

Habitat.—Pacific.

One individual of this colossal species was taken in September 1874 in the Arafura Sea; it had been treated with picro-sulphuric acid and preserved in alcohol, and was therefore in very good condition for study.

Its *length* was 6 cm., height of the body proper 13 mm., and diameter 8 mm.; the height of the frontal papillæ was 4·5 mm., of the whole rhinophoria 11 mm., and of the anterior dorsal papillæ quite 12 mm.; the breadth of the foot 5 mm. The *colour* was a clear brownish-yellow (owing no doubt partly to the picric acid); the liver was visible through the sides of the body, and on the right side the greenish-grey intestine also.

The *form* of the body was quite as usual. It was stretched and somewhat compressed, broader above than below. The *head* (Pl. VII. fig. 13) rather large, marked off from the

[1] The creation of this species is a good example of the "species manufacturing" of many writers. I myself, who have worked at the genus *Bornella* itself and the literature, found among the drawings of Semper a *Bornella* which is quite unrecognisable, and which therefore I quote as "*Bornella*, sp., Semper MSS." Crosse, who has no proper notion of the structure of *Bornella*, explains in an entirely worthless memoir (Note sur les genres Bornella et Placobranchus, *Journ. d. Conchyl.*, sér. 3, t. xv., 1875, pp. 322–325) this figure as a new species, *Bornella semperi*. His method of investigating such forms is also illustrated by the creation of another species, *Bornella caledonica* (Nudibr. de la Nouvelle Calédonie, *Journ. d. Conchyl.*, sér. 3, t. xv., 1875, p. 318, pl. xii. fig. 10). Writers of this kind are a burden to science, and Malacology has had enough of them.

foot beneath by a furrow, and from the dorsal portion of the body by a shallow groove behind the rhinophoria. The anterior extremity slants steeply downwards and backwards. The *mouth* (fig. 13, *a*) is provided with a pair of thick lips, which unite above and are connected below by a transverse piece; internally are a number of folds and furrows which converge to the wide mouth opening. On the side of the head, not far from the lips, are the peculiar *tentacles* (fig. 13, *b*), from fifteen (on the right side) to sixteen (on the left) in number, almost cylindrico-conical in shape, and measuring about 2·5 mm. in length; these are arranged in a double or triple series, and take their origin from a low crescentic basal piece which is a little higher behind. Behind these are the obliquely situated powerful compressed *rhinophoria* (fig. 13, *c*), which are attached to the "neck" and very close to each other. From the long but narrow base the powerful stalk takes its origin, which at its upper end is slightly broader and thicker (breadth 7 mm., thickness 3 mm.); the outer portion of the stalk ends in the rhinophore proper, while the inner part (fig. 13, *d*) is continued upwards into the papillary portion. The rhinophore has the customary sheath with its three finger-like processes (fig. 13, *c*, and fig. 14); these all measure about 3 mm., and are rather flattened. The club of the rhinophore is some 3 mm. high, and has 40 or 50 broad leaves on both sides.[1] The upper margin of the papillary part has four compressed points, of which the outermost but one is the largest. The eyes are not visible from the exterior. The *dorsal surface* is for the most part rather broad, and is narrower at the posterior extremity only; it is rounded and not marked off from the sides of the body. From the margin of the back spring the five strong *branchia-bearing papillæ;* the distance between the rhinophoria and the first pair of papillæ is rather long, nearly as long as the distance between the first and second pair of papillæ, or the second and third; the distance between the third and fourth pairs is a little shorter, and soon after this follows the fifth pair. The papillæ are situated almost exactly opposite each other; only the fifth on the right side is somewhat further back and also smaller than its fellow on the left side; in other respects the two corresponding papillæ were nearly of equal size. In the middle of the first inter-papillary space (a little nearer to the second papilla), near the right dorsal margin, is the slightly prominent *anal papilla*, in front of which is the fine *renal pore*. The papillæ are rather sharply differentiated from the dorsal wall, on which they are set somewhat obliquely; each papilla is separated from its fellow by a rather narrow space, which in the case of the fourth papilla has quite disappeared. The *first papilla* (Pl. VIII. fig. 1) is a little compressed, and continuous above with the three likewise rather compressed finger-like processes, of which the middle one is the largest. Above the base, in the neighbourhood of the anterior and posterior margins on the outer side, is a small branchial tuft, protected by a cylindrical finger-like process; similarly on the inside, but rather higher, are tufts, but without a covering. The branchiæ are irregularly tri- and quadri-pinnate, and are provided with a short stem; the leaves

[1] Bergh, Malacolog. Untersuch., *loc. cit.*, p. 290, Taf. xxxvii. fig. 13.

are rather flattened. The *second* papilla is rather smaller than the first, but otherwise just like it; the left hand organ is also prolonged but into only two finger-like processes, and has on the inside a large posterior, and a small anterior branchia. The *third* papilla is smaller still, and is prolonged into one or two thick finger-like processes above, with the usual two branchiæ on the outside, but only one on the inside. The *fourth* papilla is rather low (4·5 mm. high), ending above in two points, with one branchia on the inside (unprovided with a cirrus). The *fifth* papilla is lower still, and prolonged above into a simple or slightly forked extremity; on the outer side of the right hand one is a small branchia with a cirrus, which is absent from the left hand branchia. The short *tail* (3 mm. long) has a high keel, ending in a point above about as high as the length of the tail.—The sides of the body are high, but decrease in height from the level of the third papilla backwards; a little below the anterior margin of the first papilla on the right is the eyelet-like wrinkled *genital aperture*.—The *foot* is rather narrow, slightly broader in front than elsewhere; from the region of the third papilla backwards it rapidly narrows; the marginal brim is about 3 mm. broad; the anterior margin (Pl. VII. fig. 13) has a superficial furrow.

The cavity of the body extends to about the region of the fourth papilla, it is fastened to the body-wall by septa of connective tissue, and by the renal tubes.

The position of the intestines has been already described by me.[1]

The *central nervous system* has the cerebro-pleural ganglia very closely united to each other; their two divisions but slightly distinguishable, the anterior is more flattened and slanting in front, the posterior division is thicker. The pedal ganglia are not much smaller than the cerebro-pleural, and are situated obliquely below them; they are, however, not so thick; from each ganglion are given off four stout nerves, bifurcated nearly from the root. The pedal commissure is barely one-third of the breadth of the ganglia themselves. In front of this commissure are the separated pleural and subcerebral commissures, and behind the pedal apparently a sympathetic. The buccal ganglia are rather large and rounded; they are united by a commissure, which is at least one-third the diameter of the ganglia; the gastro-œsophageal ganglia are about one-fourth the size of the buccal, and are provided with a short stalk. The nervus opticus is quite twice as long as the diameter of the central nervous system; that portion of it nearest the eye shows black pigment; the nervus olfactorius dilates into a small ganglion, nearly as big as the buccal ganglion at the base of the club of the rhinophore.

The *eyes* are large, the lens[2] yellow in colour, the pigment black. I did not succeed in discovering the otocyst. There were no spicules in the leaves of the rhinophoria, nor in the skin; in the latter there were, on the contrary, masses of variously sized unicellular

[1] Bergh, *loc. cit.*, p. 292.

[2] The lens appeared in both eyes to be composed of a number of spherical pyramids; but this may have been a *post-mortem* appearance.

glands scattered thickly about and arranged in groups. The fibres and lamellæ of the *interstitial connective tissue* showed the usual structure.

The mouth tube was as usual.[1] The *bulbus pharyngeus* of the ordinary form, a little depressed, and about 6 mm. long by 5 mm. broad and 4 mm. high. The musculi retractores superiores (mediani and laterales) as in other species;[2] they belong properly to the mouth tube. The *labial disk* is large and very thick; it is quite similar to that of other species;[3] at the anterior margin the *labial plates* are of a dirty yellow colour, above and below they nearly meet in the median line, the surface is finely striated; their length is 3·5 mm., breadth not quite 2 mm.[4] They displayed along the middle of their length the usual rows of small scales (Pl. VII. fig. 15), measuring about ·007 mm. in breadth; at the anterior margin there were a number of small columns, about ·04–·08 mm. in length.[5] Behind the labial disk is a large *muscular mass upon the fore part of the mandibles*, consisting of the two usual layers.[6] Behind this again are the *mandibles* (Pl. VIII. figs. 2, 3), of a chitinous yellow colour, deepening to brownish-black upon the masticatory edge; each measures 3·5 mm. in length, 2·25 in breadth, and ·5 mm. in height. In shape they resemble those of other *Bornellæ;* on the inside beneath the hinge and near the masticatory edge, there is a triangular excavation (fig. 3, *b*); the masticatory edge (fig. 2, *b*) is roundly indented; there is no masticatory process. The mouth slit is narrow, the accessory buccal cavities small. The buccal cavity is narrow and entirely occupied by the high compressed tongue. The *tongue* is provided with a narrow radula, brownish-yellow in colour, and not excavated along the rhachis; it is made up of seventeen *rows of teeth* on the high anterior margin, and three on the shorter upper margin;[7] farther back, within the stout somewhat longer radula-sheath, there were nineteen developed and two undeveloped series of plates, making a total of forty-one. The most anterior (lowest) row (of the tongue) is only represented by the median tooth; the next series consists of a median tooth, and one lateral tooth on one side, and seven on the other; the succeeding rows are more complete, the first fourteen rows still incomplete and provided with a considerable number of worn-out teeth (Pl. VII. fig. 16). The *median teeth* (Pl. VIII. figs. 4, 5, 6, 7, *a*) are reddish-yellow, almost chestnut in colour; the *lateral teeth* clear yellow, darker at the base. The breadth and height of the median teeth at the middle of the tongue were each about ·12 mm., and those, situated posteriorly, appeared to measure about the same. The length of the hook of the lateral plates averages about ·1 mm. The *median teeth* (figs. 4–7) have the usual form; on

[1] Bergh, *loc. cit.*, Taf. xxxvi. figs. 9, *c*, 10, *c*.

[2] *Loc. cit.*, figs. 9, *aa*, 10, *a*—fig. 9, *bb*.

[3] *Loc. cit.*, p. 294.

[4] *Loc. cit.*, Taf. xxxvi. figs. 11–14, *f*.

[5] A vast quantity of cnidæ were adherent to the labial disk.

[6] Bergh, *loc. cit.*, p. 293.

[7] The rhachis of the tongue was covered with a greyish mass, which proved to be made up of densely entangled masses of cnidæ.

either side of the terminal point are twelve or thirteen denticles,—only ten or eleven in the most anterior teeth. The *lateral teeth* (figs. 7, *b*,*c*, 8) consist as usual of a long basal portion, and a straight or slightly bent smooth-edged hook, which terminates in a fine point.[1] The number of lateral plates on the tongue is about seventeen or eighteen on each side; farther back within the sheath there are as many as nineteen. The innermost lateral plate (fig. 7, *b*,*b*) is very minute, the hook measuring scarcely ·007 mm.; the next one has a far more strongly developed "hook," some ·015 mm. high, and the eight or nine that follow gradually increase in size; the next four or five are of about the same length as the last; the one that follows these has a rather shorter "hook," and finally, the two outermost (fig. 8, *a*) are quite short, the length of the hook not exceeding ·025—·035 and ·0015 mm.

The yellowish *salivary glands* are flat and not very compact, meeting each other in the middle line; they are situated at the anterior edge, and at the lower surface of the first stomach. The ducts were quite as usual.

The *œsophagus* (Pl. VIII. fig. 9, *a*) is rather short (only 5·5 mm. long) and wide, passing behind into the thin walled *first stomach* (fig. 9, *b*), which is about double its breadth, and round in shape; its length is about 4 mm.; on the upper surface of this open the two lobes of the liver, one on each side, that on the left being somewhat larger than the right hand one. Not far from the aperture of the left liver, just at the junction of the first and second stomachs, is the opening of the somewhat wider main bile duct (fig. 9, *c*). The interior of the first stomach has a number of longitudinal folds, which become higher behind, and partly terminate at the opening of the bile ducts; the openings of the two livers were guarded by a valve-like fold. The first stomach is inclined at a somewhat oblique angle to the *second stomach* (fig. 9, *f*), which is spindle-shaped, and 8 mm. in length by 3·5 mm. in width; it is greyish in colour, and shows a number of fine longitudinal lines. This stomach has a largish number (perhaps eighty) of folds which extend from one aperture to the other; they are situated at short irregular intervals from each other, and bear a number of black *prickles* (fig. 10), either standing perpendicularly or directed backwards; these prickles attain a height of ·8 mm., and are of a dirty brown or blackish-brown colour; in form they are straight and cylindrical, sometimes rounded off or swollen at the upper extremity; their structure (fig. 11) is fibrous, as in other species of the genus *Bornella*,[2] and fissile; their interior showed, at least in the clearer prickles, a cellular structure (fig. 11). The first portion of the *gut* (fig. 9, *g*) is about as long and broad as the second stomach, passing by a narrow opening (fig. 9, *h*) into the rectum (fig. 9, *i*), the posterior portion of which is somewhat narrow, and opens on the anal papilla, behind the second section of the hermaphrodite gland; the length of

[1] Among the worn-out teeth were several that displayed a peculiar brownish colour upon the end of the hook (Pl. VII. fig. 16).

[2] Bergh, *loc. cit.*, p. 296.

the whole intestine is about 2 cm. The interior of the first division of the intestine is traversed by numerous fine longitudinal folds, one of which is much stronger than the rest, and passes through the small cylindrical portion which joins the anterior and posterior divisions of the intestine, it can be recognised from the outside. In the rectum the folds are not so strongly developed. The *contents* of the whole *digestive tract* form a brownish-black mass of unrecognisable animal débris; in the stomach there were fragments of Hydroid polyps, Copepoda, and torn prickles of the stomach itself.

The *two anterior livers* (fig. 9, *c*,*c*) are small, the right hand one is formed of two lobes, and is a little larger than the left hand one (length 5 mm.); both open into the first stomach, into which also opens the *chief mass of the liver* (fig. 9, *d*) by its short wide bile duct (fig. 9, *e*). The liver measures 3 cm. in length, and has a diameter of 5 mm. anteriorly, 2·5 mm. posteriorly, and about 7 mm. in the middle; it was a trifle flattened, its colour like that of the anterior livers, brownish-blackish-grey; it is divided into a number of disk-like lobes, by fewer or more superficial transverse furrows. It has no traces whatever of any prolongations into the papillæ, nor are there any traces on the body-wall of cavities at the base of the papillæ for the reception of such diverticula. The walls of the liver are thin and delicate, and show a quantity of transverse anastomosing trabeculæ; the cavity extends throughout the liver. The contents of the liver were precisely similar in character and appearance to the contents of the rest of the alimentary canal.

The *heart* is like that of other species of *Bornella*,[1] the ventricle quite spherical, and about 2 mm. in size. The course of the posterior aorta has been already described by me.[2] Transverse sections of the dorsal papillæ showed an opening on either side for the arteria and vena papillaris (branchialis).

The *renal syrinx* was attached to the outer side of the rectum; it was pear-shaped, and had a length of 2·5 mm. Its colour was yellowish-white and the longitudinal folds were quite visible from the outside. The *urinary chamber* has been already described by Hancock and myself;[3] its breadth is ·4–·5 mm.; it gives out numerous branches from both sides, and shows the usual knobs. The strongly branched *renal tubes* (fig. 12) surround the intestines, and contrast by their whitish colour with the liver and hermaphrodite gland.

The rather pale ochre-yellow *hermaphrodite gland* is 14 mm. long by 7 mm. broad, and 3 mm. high, and covers the upper and (further back) the left side of the anterior half of the liver, and is somewhat sunk within its surface, but is marked out from it by the contrast of colour; it consists of nine not quite equal lobes, all of which, with the exception of the foremost, are paired. The lobes are roundish (fig. 13), and strongly facetted; the free surface is finely granulated, the granulation being not so distinct upon the facets. The structure (Pl. XVII. fig. 17) of the lobules is as usual; the white club-shaped

[1] Bergh., *loc. cit.*, p. 298, pl. xxxvii. fig. 8. [2] Idem. [3] Bergh, *loc. cit.*, p. 299.

testicular portion bears numerous and variously sized ovarian follicles. The *hermaphrodite duct* takes its course along the furrow on the under surface of the gland, and is formed of numerous ductules (fig. 17, *a*), which unite together; it passes over to the posterior portion of the mucous gland and swells out into an ampulla.—The *anterior genital mass* is longish and rounded-subquadrangular in shape; it is more convex upon the upper side than upon the lower; its length is 9 mm., breadth 7 mm., and 5·5 mm. in height. On the upper side are the windings of the yellowish, strong vas deferens, which ends in front in the large penis; the latter forms the anterior end, and is generally more than one-half of the genital mass. The backward continuation of the vas deferens passes round the left margin of the genital mass, and runs along its under surface as far as the ampulla of the hermaphrodite duct, which latter forms the hinder end of the genital mass. The *ampulla*, which is situated beneath the hinder end of the genital mass, is yellowish in colour, small, and rather thin. The *vas deferens* is long and strong, its length is 4·5 cm., and the diameter everywhere 1·5–1 mm.; the longer hinder part of it (fig. 20, *c*) probably acts as a prostate gland, it is yellowish in colour, but somewhat less stout than the anterior muscular portion (fig. 20, *b*), which is about 1·6 mm. long; these two divisions are separated by a constriction (fig. 20, *a*). The *penis* is short and sac-like, slightly arched, 8 mm. in length with a diameter of 4 mm.; the wall is rather thick, the structure of the whole organ resembles that of other species of *Bornella*. The short inferior portion is unevenly wrinkled on the inside; the remainder is smoother and lies between two similar stout *festoons*. These structures are usually 1–1·5 mm. in thickness and the same height; they unite with each other below (fig. 19) and above (fig. 18) the circular orifice (fig. 18, *a*) of the vas deferens; they have the margins as well as the surface somewhat wrinkled. On the margin are developed a number of black *spines* (altogether about 220) arranged in a single row. These spines (figs. 21, 22) are found in furrows at the rounded summit of cones, about twice as high as the spines themselves; the tissue of these cones is prolonged for a short distance up the axis of the spines, which are therefore very firmly attached, and do not easily break off. The straight, slightly S-shaped spines are of the average height of ·28 mm.; their contour is rounded; they are broader below, and end in a point above. The *spermatheca* is pear-shaped, about 2 mm. long, and lying on the right side of the mucous gland, it was distended with semen; its duct, hardly as long as the organ itself, opens into the vestibulum genitale close to the opening of the *mucous gland*. This latter organ is yellowish, but chalky white on the under surface and on the left side; at the hinder end it has a large brown twist, which is blackish-blue above; the efferent duct is short, and has the usual fold.

The species I have just described is strikingly different from the three other previously examined species of *Bornella* (*Bornella calcarata* from the Antilles Sea, *Bornella digitata*

and *Bornella arborescens* from the Southern Sea).[1] It comes nearest, however, to the last-mentioned of the three, but differs sufficiently in the form of the dorsal papillæ and the character of the branchiæ and their appendages; it agrees with these last two species in possessing denticulated median plates in the radula, but the shape of the spines of the penis is quite different.

Family Tritoniadæ.

This Family is in some respects intermediate between the kladohepatic Nudibranchiata (Æolidiadæ) and the holohepatic Nudibranchiata (Doridida), but presents more affinities to the former group. With the latter it agrees in the possession of a simple unbranched liver, and in the absence of a sanguineous gland and of a spermatocyst. It contains but few types, which differ but slightly from each other, both as regards outward form and internal structure.

The *body* is elongated and slightly quadrangular, the anterior portion is broader, the posterior narrowed; the dorsal surface is flattened and granular in appearance; the sides of the body are high and perpendicular; the foot is broad. At the anterior extremity the back acquires a crescentic prominence—the *frontal veil;* the free margin of this is covered with small papillæ, or with simple, sometimes compound, finger-shaped processes; the outer extremity is thickened and forms a spoon-shaped structure—the *tentacle* proper. The *rhinophoria* are situated on the "neck," just behind the frontal veil. The sheath of the rhinophoria is tubular and slightly depressed, with a recurved margin; the sword-knot-shaped club is retractile, the central portion has a flattened upper surface, the margin is set with erect feather-like processes, the rhachis of the hindermost process is continued into a rather strongly developed papilla. On the slightly prominent margin of the back there are a number of variously sized *branchial tufts,* arranged one behind the other in a single series; they are low, more or less arborescent, tri- or quadripinnate, and are set on a short stalk. The *anal papilla* and the *renal aperture* are situated close to each other about the middle of the body on the right side. The *foot* is rather broad and rounded at its anterior end; the tail is very short.

The *bulbus pharyngeus* is strongly developed, and resembles that of the Pleurophyllidiadæ, as do also the *mandibles* especially. The *tongue* is well developed; the radula consists of a median tooth, on each side of which is a longer (*Tritonia*) or a shorter (*Candiella, Marionia*) series of uncinate lateral teeth; the first lateral tooth always differs from the rest. The stomach is generally unarmed, but in *Marionia* it is provided with a belt of hard longitudinal plates. The *liver* is large, and forms a short conical mass; the anterior part either shows traces of becoming separated from the rest or is actually separate (*Marionia*). The liver sends off no branches into the dorsal papillæ

[1] For a description of these species, *see* Bgh., *loc. cit.*, pp. 289, 301.

as it does in *Scyllæa*, and there is no trace of the peculiar relations between the liver and the branchial organs which are seen in the kladohepatic Nudibranchiata. There is no trace of the *sanguineous gland*, which is characteristic of the holohepatic Nudibranchiata. The *hermaphrodite gland*, as in the last-mentioned group, surrounds the liver, and is not separate from it as in *Scyllæa*. The *spermatheca* is large, but there is no spermatocyst present. The *penis* is unarmed.

The Family of the Tritoniadæ as now known[1] includes two (or three) generic groups. Firstly, *Tritonia*, which may again be divided into (1) *Tritonia*, characterised by the great development of papillæ upon the frontal margin and by the radula possessing a great number of lateral teeth; and (2) *Candiella*, characterised by the development of finger-shaped processes upon the frontal margin, and by the smaller number of lateral teeth on the radula. Secondly *Marionia*, and the somewhat doubtful genus *Hancockia* of Gosse,[2] which perhaps belongs to this family also.

The Tritoniadæ are carnivorous animals, feeding chiefly on Alcyonarians and allied forms. The *spawn* of some species of *Tritonia* from the North Atlantic has been described. Nothing is known about their development; Gosse simply mentions the Nautiloid shell in *Hancockia*.

I. *Tritonia*, Cuvier.

Limbus frontalis papilligerus vel digitatus. Ventriculus non armatus.

The Tritoniæ proper differ from the Marioniæ by the simple papillæ of the frontal veil, and by the stomach being unarmed. The genus may be divided into two subgenera.[3]

Sub-genus 1. *Tritonia*.

Margo veli frontalis papilliger. Radula dentibus lateralibus numerosis.

The genus contains the following species:—

1. *Tritonia hombergi*, Cuvier.
   Atlantic Ocean, Mediterranean.
2. *Tritonia rubra*, Leuckart.
   Red Sea.
3. *Tritonia tetraquetra* (Pallas).
   Pacific Ocean, neighbourhood of Aleutian Islands.

[1] *Cf.* My monograph of the Tritoniadæ, which will shortly be published, and which will form Heft xv. of my Malacologische Untersuchungen (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.).

[2] P. H. Gosse, On Hancockia eudactylota, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xx., 1877, pp. 316–319, pl. xi.

[3] *Cf.* My monograph on Tritoniadæ, *loc. cit.*

4. *Tritonia palmeri*, Cooper.
   Pacific Ocean.

5. *Tritonia reticulata*, Bergh.
   Japanese Sea.

6. *Tritonia hawaiensis*, Pease.
   Pacific Ocean, neighbourhood of Sandwich Islands.

7. *Tritonia pallida*, Stimpson.
   Cape of Good Hope.

8. *Tritonia challengeriana*, n. sp.
   Pacific off Patagonia.

9. *Tritonia* (?) *cucullata* (Couth.), Gould.
   Western Atlantic off Rio Janeiro.

Sub-genus 2. *Candiella*, Gray.

Margo veli frontalis digitatus. Radula dentibus lateralibus non numerosis.

The genus contains the following species :—

1. *Candiella plebeia*, Johnston.
   Atlantic.

2. *Candiella lineata*, Alder and Hancock.
   Atlantic.

3. *Candiella* (*Duvaucelia*) *gracilis* (Risso).
   Mediterranean.

4. *Candiella manicata* (Deshayes)=? *Nemocephala marmorata*, A. Costa.
   Mediterranean.

Tritonia challengeriana, n. sp. (Pl. XI. figs. 16–19 ; Pl. XII. figs. 1–8).

Habitat.—Southern Pacific. Off the coast of Patagonia.

Two specimens of this interesting form were dredged at Station 308, off the west coast of Patagonia, from a depth of 175 fathoms, on January 5, 1876. Both specimens were nearly of the same size, and were well preserved. I dissected both.

The length of the animal is about 3·5 to 4 cm., the height of the body proper 1·2–1·4 cm., the breadth 1·5–1·8 cm. ; the breadth of the frontal veil 8–10 mm., the length of

the rhinophorial sheaths 2 mm., of the rhinophoria 2 mm.; the length of the branchial tufts from ·5–2 mm.; the breadth of the foot 6–8 mm. The *colour* differed in the two specimens, one being whitish-yellow and the other more grey; in both the rhinophoria were of a whitish tint, the branchial tufts, anal and genital papillæ white or lemon-yellow, and the foot yellow.

The *form* of the body is similar to that of the other members of the same genus. The frontal veil is semilunar in shape with a notch in the middle line, it has from fifteen to twenty shallow indentations; the *tentacles* are large, and present no peculiarities of form; the sheath of the *rhinophoria* is short and cylindrical, with plain margin; the club-shaped extremity of the rhinophoria is provided with about ten leaf-like appendages, the apex of the hindermost of these is very strong. The *dorsal surface* is almost even, with scattered minute tubercles; on the but slightly prominent margin of the back are from twenty-five to thirty variously sized small branchial tufts which present the usual structure. The sides of the body are rather high and quite smooth. The genital and anal papillæ and the renal pore occupy their usual positions. The furrow on the anterior margin of the foot is very distinct; the tail is only present as a rudiment.

The intestines are not visible through the body-wall.

The *central nervous system* has no peculiarities; the pedal ganglia are somewhat larger than the cerebral. The long principal commissure gives off a nervus genitalis. The buccal ganglia are large and oval in form; the gastro-œsophageal are very small.

The *otolithic vesicles* are situated at the anterior margin of the pleural ganglia. Each contains about one hundred otoconia of the usual kind.

The *bulbus pharyngeus* is large, and measures from 7·5–10 mm. in length, 5–6 mm. in height, and 6–7·25 in breadth. The labial disk, as well as the posterior part of the mouth-tube, is of a dark blackish-brown colour. The *mandibles* are of a greenish-yellow hue, the masticatory edge coal black, and the adjacent part brownish-black. The form of the mandibles (Pl. XI. fig. 16) as usual. The masticatory edge appears even under the lens; nevertheless it is provided with several, mostly eight or nine, series of short, thick, strong plates and teeth, which gradually increase in size towards the anterior margin, the foremost measuring as much as ·12 mm. (fig. 17). The free margin of the wings behind the mandibles is blackish. The *tongue* is of the usual form, and blackish in colour along the median line of the under surface; the radula varies from mahogany-brown to black, and contains twenty-four and twenty-seven series of teeth in each of the two individuals examined respectively; posteriorly there are seven and thirteen developed, and three not fully developed series, the total number of series being thus thirty-four and forty-three in each of the two specimens. In the hindermost series there were thirty-five teeth in one specimen and forty-two in the other, and the number of teeth further back within the sheath of the radula increases to thirty-seven and forty-five. The breadth of the most anterior median tooth is about ·22 mm., of the hindermost about ·28 mm.; the height of

the lateral teeth ·25 mm., of the outermost ones ·16 mm. The colour of the teeth within the radula sheath of a bright yellow, those anterior being darker in hue. The median plates (fig. 18, *a*) of the usual shape, as also the clumsy first lateral plate (fig. 18, *b*,*b*); the rest of the teeth are somewhat low and curved towards the point (Pl. XII. figs. 2–5), most ones are more slender in form (fig. 6).

The *salivary glands* are whitish in colour, and measure from 10–14 mm. in length by 1·5–2·25 mm. in breadth. The efferent ducts are rather long.—The *stomach* and œsophagus were as usual, measuring together 13 or 14 mm. in length by 5–7 mm. in breadth; the inner surface was thrown into a series of longitudinal folds; the aperture of the main bile duct was large. The *intestine* leaves the large visceral mass at about the middle point; its length is about 16 or 17 mm., its diameter 3 or 3·5 mm., the inner surface covered with strong longitudinal folds. In both specimens the buccal cavity, œsophagus, and stomach were filled with a hard brown mass, consisting of the funnel-shaped remains of an Alcyonarian (up to a height of 5·5 mm.);[1] the intestine was mainly filled with the elongated spicules of the same animal. The *liver* (visceral mass) was 17–18·5 mm. in length, by 7·5–10 mm. in breadth; the anterior end obliquely truncated, the posterior end rounded; its colour was a dirty brown, darker inside than outside; its cavity rather narrow.

The *pericardium* and the *heart* were as usual. The *renal syrinx* (fig. 7, *a*) 1·1–1·2 mm. in length, yellowish-white in colour, with a series of strong longitudinal folds in the inside; the duct was greyish-brown in colour, the inner surface provided with arborescent overgrowths (fig. 7, *b*).

The *hermaphrodite gland* forms a single mass, whitish in colour, and composed of a great number of lobes; it clothes the upper and posterior portion of the large visceral mass; the gonoblasts are developed in the lobes.—The *anterior genital mass* is elongated and somewhat compressed, with a length of 9–10 mm., a height of 5–6 mm., and a breadth of 3–4 mm.; the efferent ducts, moreover, project for 2·5 mm. The *ampulla* of the hermaphrodite duct forms the hinder portion of the genital mass; its colour is an opaque yellowish-white, its shape elongated, somewhat curved at either end, its length 2·2 cm., its greatest diameter 2·5 mm. The *ductus ejaculatorius* (Pl. XI. fig. 19, *aa*) is coiled up on the inside of the penis; when unrolled it measures nearly 2 cm. in length. The penis is pear-shaped and about 2 mm. long; the glans is conical in form and elongated, one half of it freely projecting (fig. 19, *d*); the seminal duct runs up to the extremity of the organ. The spermatheca (Pl. XII. fig. 8, *a*) is oval, 2·5 mm. long, and in both specimens was completely empty; it opens by a duct (fig. 8, *b*), which, at its distal end, was dilated into an ampulla (fig. 8, *c*). The *mucous gland* was of a chalk white colour; the *albuminiparous gland* yellowish, with fine windings.

[1] Beiträge z. Kenntn. d. japan. Nudibr. II., *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien.*, Bd. xxxi. 1881, pp. 248, 249.

II. *Marionia*, Vayssière.

Marionia, A. Vayssière, Sur un nouveau genre de la famille des Tritioniadés, Comptes rendus, t. lxxv., 1877, pp. 299–301.

„ A. Vayssière, Description de la Marionia Berghii, Journ. de Conchyl., sér. 3, t. xix., 1879, pp. 106–118, pl. vii.

„ R. Bergh, Beitr. zu einer Monogr. d. Gatt. Marionia, Vayss., Mittheil. d. zool. Stat. zu Neapel, Bd. iv., 1883, pp. 297–320, Taf. xxi.

Forma corporis ut in Tritoniis propriis ; limbus frontalis digitatus, digitis compositis numerosis.

Ventriculus lamellis solidis armatus.

The genus *Marionia* is readily distinguished from *Tritonia* by the form of the processes of the frontal veil, and by the armed condition of the stomach.

A number of species have been referred to this genus, many of which may possibly prove to be identical ; they are as follows :—

1. *Marionia blainvillea* (Risso).
   Marionia berghii, Vayss.
   Mediterranean.

2. *Marionia decaphylla* (Cantraine).
   Mediterranean.

3. *Marionia quadrilatera* (Schultz).
   Mediterranean.

4. *Marionia affinis*, Bergh.
   Mediterranean.

5. *Marionia tethydea* (delle Chiaje).
   Mediterranean.

6. *Marionia costæ* (Verany).
   Mediterranean.

7. *Marionia meyeri* (Verany).
   Mediterranean.

8. *Marionia acuminata* (O. G. Costa).
   Mediterranean.

9. *Marionia elegans* (Audouin, Savigny).
Red Sea.

10. *Marionia cyanobranchiata* (Rüppell und Leuckart).
Red Sea.

11. *Marionia occidentalis*, n. sp.
Western Atlantic.

Marionia occidentalis, n. sp. (Pl. XI. figs. 3–15).

? Tritonia cucullata, Couth., Gould., Expl. Exped., Moll., 1852, p. 308, pl. xxv. fig. 403, *a.-f.*

Habitat.—Western Atlantic. Off Buenos Ayres.

This species may be identical with *Tritonia cucullata* of Gould, from the shores of Rio Janeiro; but since this identity, even if it exists, will probably never be certainly proved, the name *Marionia occidentalis* may stand.

One specimen only was dredged on February 25, 1876, from a depth of 13 fathoms, in lat. 35° 2′ S., long. 55° 15′ W., in the bay of Buenos Ayres. It was well preserved in alcohol.

The total *length* of the individual was 4·3 cm., its height 9 mm. and breadth 10 mm.; the breadth of the foot 8 mm.; the length of the rhinophoria 4 mm., that of the branchiæ 4 mm. The *colour*[1] of the animal was of a bright grass green; the dorsal surface is divided by lines into a number of green polygonal areas. The clubs of the rhinophoria and the points of the branchial leaves, as well as of the finger-like processes of the frontal margin, are whitish or light yellowish-grey. The sides are of a whitish colour, which becomes greenish towards the edge of the mantle; they are covered all over with a number of round or longitudinally oval slightly prominent white spots. The circumference of the mouth and the margin of the foot are greenish, but the under surface is yellowish.

The body is somewhat slender; the crescent-shaped *frontal veil* is small and provided with about twenty finger-like processes, which resemble those of other species of the genus; the *tentacles* are spoon-shaped and not strongly developed; the club of the *rhinophoria* is provided with about ten bipinnate appendages; the terminal papilla of the rhachis of the hindermost one is very prominent. The *branchiæ* are, as in the other representatives of this genus, distributed along the margin of the dorsal surface—thirteen on each side—the posterior being much smaller than the other. That portion of the dorsal margin which lies between the branchiæ is concave. Each *branchia* consists of a stem, which is divided into four, three, and two branches, which are again divided into two and three branchlets, which terminate in bipinnate twigs. The *genital papilla*

[1] The living animal is probably green on the upper surface and reddish over the rest of the body.

occupies its usual position beneath the second interbranchial space; from it projected the conical glans penis, which attained a length of 4 mm. The *anal papilla* and the minute renal pore are situated beneath the fourth interbranchial space. The *foot* resembles that of other *Marioniæ*, the free margin projecting about 1·75 mm.; the *tail* measured about 2·25 mm. in length, and had a triangular crest 2·25 mm. in height.

The viscera are not visible through the body-walls.

The *central nervous system* is small; the cerebro-pleural ganglia (Pl. XI. fig. 3, *a*,*b*) are reniform in outline, and the two divisions are quite distinct, and the anterior is somewhat larger. The cerebro-pedal and pleuro-pedal connectives are very distinct; the nervus vaginæ rhinophorii, nervus olfactorius, nervus tentacularis, nervi frontales, nervi palliales, nervi musculares bulbi, nervus opticus and ganglion opticum resemble those of other *Tritoniæ*. The pedal ganglia (fig. 3, *c*,*c*) are rounded and short stalked, they are a little larger than the cerebral; the nervi pediaei as usual. The olfactory, buccal (fig. 3, *g*), and gastro-œsophageal ganglia (fig. 3, *hh*) are like those of other *Tritoniæ*.

The *eyes* (fig. 3, *i*) are situated as usual at the base of the rhinophorial sheath; they are oval in form, about ·22 mm. in diameter, and are provided with a large lens and black pigment. The large *otocysts* (fig. 3) are placed either behind or upon the pleuro-pedal connective; each contains about 100 otoconia, the largest of which have a diameter of ·03 mm.

The *mouth-tube* with its retractor muscles was quite typical. The *bulbus pharyngeus* measured 10 mm. in length, 6 mm. in height, and 7 mm. in breadth; it is not different from that of other species of *Marionia*; as in *Marionia quadrilatera*, the black, deeply pigmented wall of the buccal cavity was visible on the upper surface of the bulbus. The labial disk is whitish in colour. The *mandibles* (Pl. XI. fig. 4) correspond in measurement with the bulbus pharyngeus. Their colour is chitinous yellow; in shape they are closely similar to the mandibles of other species of the same genus, differing merely in being somewhat narrower, and in having a more pointed posterior extremity; the masticatory process (fig. 4, *a*) is long, the masticatory edge (figs. 5, 6) straight and armed along its whole length with three or four series of denticles, the highest of which measure about ·12 mm. The *tongue* is of the usual form; the radula, of a chitinous yellow colour, stands out in marked contrast to the rest of the organ, which is black. The radula contains forty series of teeth (counted along the outer margin); further back, beneath the tectum radulæ and within the radula-sheath, there are eight fully-developed series of teeth, one half-developed, and three delicate transparent series; the total number of series of teeth is thus fifty-two. The greatest number of teeth contained in one of the anterior series of the sheath was eighty, but nearly all the series of the tongue were incomplete. The breadth of the oldest median teeth was ·28 mm., of the newest ·39 mm.; the length of the outermost plates on the posterior portion of the radula was ·12, ·16, ·2, and ·25 mm., the longest measured as much as ·4 mm. The median teeth

(Pl. XI. fig. 7, *a*,*a*) and the first lateral tooth (fig. 7, *b*,*b*) closely resemble those of other species of *Marionia*. All the (other) lateral plates (figs. 8–11), with the exception perhaps of the outermost ones, are covered on their outer edge with fine oblique striations, and the outer margin of the recurved extremity (fig. 12) is very finely serrated; sometimes a similar striation is seen on the inside (fig. 10). The outer teeth (fig. 11) have the normal form. There were present also (Pl. XI. fig. 8) a number of irregularly formed teeth.

The *salivary glands* resemble those of other *Tritoniæ;* they are whitish in colour and measure about 7 mm. in length and 2·5 mm. in breadth; the efferent duct is about 3 mm. long.—The œsophagus is like that of other *Tritoniæ*. The *first stomach* is spherical, with a diameter of 5·5 mm.; the second short and cylindrical, with a length of about 1·5 mm. *Chitinous plates* are developed in the *second stomach*, and are visible through its walls; they are pale yellow in colour and variable in form; they were present to the number of sixty; a larger plate frequently alternated with one, two, or three smaller plates; the length of the larger plates was about 1·13 mm., and the height ·6 mm.; two of the plates were considerably larger than the rest (fig. 13). The *intestine* passes over the succenturiate liver; it is 14 mm. long by 2–1 mm. in diameter; a thick fold was developed on its inner wall, ending in a freely projecting extremity at about the end of the first half. The whole digestive tract, from the mouth to the anus, was filled with animal débris, apparently of Alcyonarians.

The *liver* is of the usual form, conical; its length is about 19 mm., and the breadth of the anterior portion about 7 mm., the colour is yellowish-white with a faint tinge of green. The *succenturiate liver* lies beneath the intestine; it is about 5 mm. broad, 3 mm. in height, and nearly 3 mm. in length; the colour is greyish-brown; the internal cavity is small, and opens by a distinct duct into the hinder portion of the first stomach.

The *renal syrinx* opens into the anterior portion of the pericardium on the right side; its shape is oval, with very strongly developed interior folds; the length is about 1·5 mm.

The *hermaphrodite gland* forms a thick whitish layer over the yellow liver; its structure was perfectly typical, in the lobes zoosperms and large oogene cells were found. The *anterior genital mass* forms an oblong somewhat compressed body of about 9 mm. in length, 6 mm. in height, and 5·5 mm. in breadth; the position of the different portions of the genital mass was normal. The *ampulla* of the hermaphrodite duct is largely developed and whitish in colour; the *ductus ejaculatorius* (fig. 14, *d*) is very long, and forms a coil at the base of the penis, which when unrolled has a length of 2·5 cm. The *penis* (fig. 14, *e*, 15) is about 4 mm. long, and projects freely; it is elongated and conical in form, and has the usual structure. The *spermatheca* (fig. 14, *a*) is spherical, of about 4 mm. diameter; the efferent duct (fig. 14, *b*) is about double the length of the sac itself; the inferior half is dilated into a vagina (fig. 14, *c*); the mucous gland is whitish, the albuminiparous gland yellowish in colour.

II. Order.—NUDIBRANCHIATA HOLOHEPATICA.

This Order comprises the Doridida and Doriopsidæ, nearly all of which, with the exception of one deep-sea form (*Bathydoris*), are littoral in habit.

Family Doridid æ.

Sub-family I. Doridida Phanerobranchiatæ.

Ohola, n. gen.

Forma corporis fere ut in *Polyceris*, sed limbo frontali simplici, recto. Branchia pauci-(3-) foliata. Appendices dorsales colosseæ, simplices. Tentacula vix ulla. Rhinophoria vaginata, clavo perfoliato.

Lamellæ mandibulares fere ut in *Polyceris* propriis. Radula fere ut in *Polyceris* propriis, rhachide nuda, pleuris dentibus majoribus hamatis duobus, et dentibus externis paucis (2).

This new genus shows a general agreement with the true *Polycera* in its outward form. The *frontal margin*, however, has no prolongations, the *branchia* has only a few (3) simple tufts. On the dorsal margin on each side are two huge papillæ. The *rhinophoria* are provided with a very marked sheath; the club is strongly perfoliated; there are no *tentacles*.—The strong *mandibular plates* are like those of *Polycera* proper (*Polycera quadrilineata*), so also the *tongue*, which has two powerful lateral teeth, and only a few (2) outer teeth. The armature of the penis is like that of *Polycera*.

Ohola differs, however, from *Polycera* in having a strong sheath for the rhinophoria, in its even frontal margin, the absence of tentacles, and the huge development of the dorsal papillæ, which give the animal a most remarkable appearance. There is but one species known at present.

Ohola pacifica, n. sp. (Pl. IX. figs. 9–22).

Habitat.—Pacific (Arafura Sea).

Of this form I found a single individual, somewhat altered in shape by pressure, in company with *Bornella excepta* and *Janolus australis;* it had been preserved in picro-sulphuric acid; the specimen was captured in the Arafura Sea in September 1874.

The specimen (fig. 9) was 13 mm. long, 5 mm. broad, and 3·5 mm. high; the length of the anterior papillæ was 4 mm., of the posterior pair 8–9 mm., the length of the

rhinophoria was about 1·5 mm., of the branchial tufts 2 mm.; the breadth of the base of the foot 5·4 mm., the length of the tail 5 mm.

The *colour* of the animal was whitish, the gill yellowish, the tip of the papillæ black, the clubs of the rhinophoria greenish-grey with a white tip. At the neck (fig. 9) the bulbus pharyngeus and central nervous system with the black eyes were visible from the outside, and the liver behind the branchia and the hermaphrodite gland at the base of the first right papilla.

The *form* of the body is remarkable on account of the huge dorsal papillæ (fig. 9, *a*,*a*), and is short and clumsy. The *mouth* is rounded, a little funnel-shaped; there is no trace of any *tentacles*. Above the quite even frontal margin, at the neck are the circular apertures for the rhinophoria, out of which project the tips of these; the club of the latter has a great number (50 ?) of the usual thin leaves. The *branchia* stands about on the middle of the back, and is formed of three tufts; the right hand one gives off a strong branch at its base. Behind the branchia is the low *anal papilla*, in front to the right of which is the renal aperture. From the lateral margin of the back, which is hardly to be distinguished from the sides of the body, arises in the neighbourhood of the rhinophoria, the *first smaller pair of papillæ*; further back, behind the region of the branchia, the *second pair* (fig. 9, *a*,*a*), which is twice as large as the first pair. The papillæ are cylindrical or club-shaped, somewhat narrower below, rounded above, and slightly excavated at the apex. The *tail* is strong. The *sides of the body* are high, less so anteriorly and posteriorly; the wrinkled genital opening lies behind the first papilla on the right. The *foot* is rather broad and strong; in front its angles are small; the lateral brim projects about ·8 mm. from the sides of the body; posteriorly it ends in a rounded apex.

The *central nervous system* is not much flattened; the cerebro-pleural ganglia are reniform, the two divisions being very distinct; the pleural are thicker and somewhat larger than the cerebral. The pedal ganglia are roundish and a little smaller than the pleural. The three commissures are separate, not quite as long as the diameter of the pedal ganglia. The proximal olfactory ganglion nearly sessile and bulb-shaped; the distal one much smaller, roundish, and situated at the base of the rhinophorial club. A small ganglion opticum gives rise to the optic nerve, which is nearly double as long as the diameter of the eye. The buccal ganglia are a little larger than the proximal olfactory ganglia, round in shape and united by a commissure about equal in length to the diameter of the ganglia. A strong nerve could be followed throughout the whole length of the papillæ as far as the apex.

The *eyes* are large, and provided with abundant black pigment and a yellow lens. The *otocysts* are rather smaller than the eyes, and contain a small number of otoconia. The leaves of the club of the rhinophoria are delicate, and contain no spicules. The *skin* and interstitial connective tissue are without spicules, and contain an enormous mass of variously sized unicellular glands. On the apex of the dorsal papillæ the skin was thicker,

containing a number of large vesicular glands; in the neighbourhood of the apex were a number of special glandular structures (fig. 21), which appeared to resemble renal tissue; the condition, however, of this part of the body hindered further research.

The wide *mouth-tube* measures about 1·5 mm. long. The stout *bulbus pharyngeus* is about 2 mm. long, 1·75 mm. broad, and 1·5 mm. high; the radula sheath projects a little beneath at the hinder end; the form of the bulbus is nearly as usual, but peculiarly flattened on the upper surface; within the oval labial disk were the dark brown edges of the *mandibular plates*, the upper transverse pieces of which were visible through the walls of the bulbus. The mandibular plates (fig. 10) resemble those of *Polycera quadrilineata*, they are strong and hard, and yellowish in colour; the length of the longitudinal piece ·75 mm., of the transverse piece ·1 mm.; they consist of two parts inclined to each other at nearly a right angle (fig. 10). The *longitudinal piece* (fig. 10, *b*) mainly lies naked in the labial disk, and is sickle-shaped; the anterior surface is rather convex, marked with several oblique lines, reaching above as far as the junction; the outer margin is strongly projecting, separated by a deep furrow from the transverse piece; the hinder surface is a little concave, reaching as far as the junction, and passes into the transverse piece by means of a rounded crest; the inner margin is a little convex above; the under end brought to a point. The *transverse piece* (fig. 10, *a*) of the mandible is scarcely longer but (especially behind) broader than the longitudinal; it lies nearly horizontally, but sloping downwards slightly in its anterior portion; the upper side is a little convex, and traversed by an oblique longitudinal crest; the under side is rather concave; from the (fig. 10) inner portion of the upper margin, quite separate from the hinder surface, a flat piece takes its rise, which extends backwards, and becomes attached to the inner margin of the longitudinal piece; there is a deep furrow between this flat extension and the longitudinal piece, and also between it and the transverse piece. The structure of the *bulbus pharyngeus* is as in *Polycera*.[1] The *tongue* is as usual, broad and strong; the chestnut-coloured radula is visible through the upper wall of the bulbus, and contains eight rows of teeth; further back there are three developed and one undeveloped rows, the total number is therefore twelve. The first row of the tongue is reduced to the inner lateral teeth, but the following series is complete; the lateral teeth of this and the following rows were somewhat worn out. The teeth had a dirty yellowish or brownish-yellow colour. The length of the outermost tooth on the hinder part of the tongue was about ·1 mm., of the next plate ·14 mm.; the innermost lateral plate measured ·2, and the large one as much as ·3 mm. The rhachis (fig. 11, *a*) is rather broad, and traversed by wavy folds. The two lateral teeth, rather similar in shape, have a flattened basal portion, and a powerful smooth hooked extremity; from the outer margin of the body arises a strong wing-shaped process. The inner lateral plate is smooth, and less

[1] Bergh, Beitr. zu einer Monogr. d. Polyceraden, I. *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, 1879, Bd. xxix. pp. 606, 607.

in size (figs. 11, *b*, 12, 13, 14, *a*), with a shorter basal portion and a shorter broader hook. The outer lateral tooth is larger, and has a much stronger hook, with an obliquely truncated posterior extremity (figs. 11, *c*, 14, *b*, 15, *a*,*a*). Of the two outer teeth one (figs. 11, *d*, 15, *b*, 16, *a*, 17), the inner one, was considerably larger and broader than the other; it measured about ·04 mm. high; on the inside it was higher, and slanted outwards. The outer tooth was shorter, narrower, and lower, coming to a point behind; on the inside it was lower (figs. 11, *e*, 16).

The white *salivary glands* were long, but thin; the *efferent ducts* short.

The *œsophagus* is rather narrow, about half as long again as the bulbus, and opens into the *stomach*, which is nearly spherical, and measures about 3 mm. in diameter; its colour is grey, and it lies partly in the wide cleft of the liver. The *gut* is thin, and breaks through the left side of the liver in a deep furrow; it forms a large arch in front of the liver and extends backwards (fig. 9, 22, *a*) to the anal papilla, measuring about 8 mm. long, and its interior shows fine longitudinal folds. The contents of the stomach were Siphonophores, Hydroids, Foraminifera, and some of the stomachal teeth of the animal itself.

The *liver* is anteriorly truncated, somewhat cup-shaped, on account of the broad and deep cleft for the reception of the stomach, and measures 4·5 mm. in breadth and length, and 3·5 mm. in height; the posterior extremity is rounded; the colour is brownish; it is smooth, with the exception of a few deep furrows in front; its cavity is rather wide. The pear-shaped *gall bladder* is large, appearing as a large facet behind the stomach on the upper surface of the liver, about 2 mm. high.

The *heart* has the usual structure. The small yellowish-white flattened, oval *blood-gland* lies behind the central nervous system.—The *urethra* (fig. 22, *b*) has a length of fully 2·5 mm., and is attached to the rectum; with the urethra is connected, by a lateral tube, the *renal syrinx* (fig. 22, *d*).

The *hermaphrodite gland* appeared, so far as could be made out, not to cover the liver, but was found underneath in front of the liver as a long, strong, yellowish mass; the lobules contained no developed sexual products.—The *anterior genital mass* was but slightly developed, about 3 mm. long. The prostate was small; the *vas deferens* was not long, nor very thin, forming a single loop, and then passing into the *penis*. This latter organ in the individual, which I examined, was retracted. The armature (fig. 18) of the anterior part of the vas deferens was ·5 mm. in length. The spines (figs. 18–20) were arranged in some ten or twelve longitudinal series, in each series nearly twenty to twenty-five; their colour was a clear yellow; the hindermost were about ·007–·009 mm. high, the most anterior ·04 mm.; the hindermost were tubercle-shaped (fig. 20), and then gradually increasing in height; the anterior ones were generally straight, but also curved and of irregular form (fig. 18). The *spermatheca* was spherical, the *spermatocyst* sac-like. The *mucous gland* was whitish in colour.

Euplocamus, Philippi.

Euplocamus, Philippi, Enum. Mollusc. Siciliæ, i., 1836, p. 103.
„ Alder, Note on Euplocamus, Triopa, and Idalia, Ann. and Mag. Nat. Hist., ser. vol. xv., 1845, p. 262.
„ Gray, Guide, Dist. Moll. Brit. Mus., part i., 1857, p. 215.
„ Alder and Hancock, Monogr. Brit. Nudibr. Moll., pt. vii., 1855, p. xix.
„ R. Bergh, Beitr. zu einer Monogr. d. Polyceraden. I., Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxix., 1880, pp. 623–639.[1]

Corpus vix depressum. Tentacula plicæformia, apice auriculatim soluta; rhinophoria retractilia, clavo perfoliato. Branchia 3 (5) foliata. Margo frontalis sicut margo dorsalis appendicibus arborescentibus ornati.

Orificium oris utrinque lamella triangulari, e baculis minutis dense confertis composita armatum. Lingua rhachide nuda, pleuris dentibus lateralibus majoribus 2–3 et serie dentium externorum breviori (5–6) vel longiori (18–35) armatis.

Prostata magna spermatothecam et spermatocystam amplectens.

The genus *Euplocamus* was established by Philippi[2] in 1836, but in 1844 the name was withdrawn by him, under the erroneous impression that it was synonymous with *Idalia*, a genus founded by Leuckart in 1828. Although Alder, in 1845, showed that *Euplocamus* was really distinct from *Idalia*,[3] the mistake of Philippi was repeated in the handbooks of Philippi, Woodward, and others, as well as throughout the compilatory works of Gray,[4] Hermannsen,[5] and others, and in the memoir of Lovèn.[6] The differences between *Euplocamus* and *Idalia* were clearly formulated by Alder and Hancock in 1855, and by Gray in 1857, but nevertheless they have subsequently been frequently confounded,[7] or *Euplocamus* has been united with *Triopa*.[8] This controversy was finally settled by a memoir written by myself in 1880, in which the external characters of *Euplocamus*, as well as its anatomy, are treated of.

Euplocamus has the frontal margin only slightly prominent but strong, somewhat branched frontal appendages, of the same nature as the lateral appendages of the back. The *tentacles* are mere folds of the skin, free at one edge like the tip of an ear; the retractile *rhinophoria* have the club perfoliated. The branchia has from three to five tripinnate

[1] This generic name has already been applied to a Lepidopteron by Latreille (1809), and later to a bird by Temminck (1838). If it is therefore to be changed, I would suggest *Kaloplocamus*.

[2] Philippi, Enum. Mollusc. Siciliæ, ii., 1844, p. 76.

[3] Alder, Note on Euplocamus, Triopa, and Idalia, *Ann. and Mag. Nat. Hist.*, ser. vol. xv., 1845, p. 262.

[4] Gray, List, etc., *Proc. Zool. Soc.*, 1847, p. 165.—Gray, Figures of Mollusc. Anim., vol. iv., 1850, p. 105.

[5] Hermannsen, Index gen. Malacozoor. prim., i., 1846, p. 435.

[6] Lovèn, Index Moll., 1846, p. 5.

[7] Chenu, Man. de Malacol., t. i., 1859, p. 406.—Verany, Catal. des Moll. de, &c., Nice. *Journ. de Conchyl.*, t. iv., 1853, p. 386.

[8] Abraham, Revision of Anthobranchiate Nudibranchiate Mollusca, *Proc. Zool. Soc.*, 1877, p. 230. Hancock, however, had long ago pointed out the great differences between *Euplocamus* and *Triopa* (Alder and Hancock, Monogr. Brit. Nudibr. Moll., pl. vi., 1854, Gen. *Triopa*, Note).

tufts. The oral orifice has a strong triangular *labial plate* on each side, composed of high upright densely set rods. The *tongue* has (always ?) a naked rhachis, three large lateral teeth on each side, and a shorter or longer series of external teeth. The large *prostate* embraces the seminal vesicles.

Euplocamus is transitional between *Polycera* and *Triopa* on the one hand and *Plocamophorus* on the other, but presents closer affinities to the latter genus. Only a few species[1] are known, all natives of the warmer seas. Nothing is known of their habits and development.

The following is a list of the known species :—

1. *Euplocamus croceus*, Philippi.
   Mediterranean.

2. *Euplocamus japonicus*, Bergh.
   Japanese Sea.

3. *Euplocamus pacificus*, n. sp.
   Pacific.

Euplocamus pacificus, n. sp. (Pl. III. fig. 30 ; Pl. IV. figs. 7–24).

Habitat.—Pacific Ocean, neighbourhood of Kermadec Islands.

Dentes linguales laterales duo, dentes externi pauci (5–6).

A single individual was dredged from a depth of 630 fathoms on July 14, 1874, between the Kermadec Islands, and was well preserved in alcohol. Its length was 27 mm., height 10·5 mm., and breadth 9·5 mm. ; the length of the rhinophoria 5 mm., two-thirds at least of which formed the club ; the length of the branchial tufts 4·6 mm., of the dorsal appendages 5 mm.; the breadth of the sole of the foot was about 5·2 mm., the length of the tail 7·5 mm. The *colour* was whitish over the whole body, except the branchia, which had a tinge of yellow, and the sulphur yellow margins of the leaves of the rhinophoria.

The *form* of the body is somewhat quadrangular ; the back rather convex. The height is greatest in front of the branchia, behind which it gradually decreases ; the sides of the body high and convex, and gradually decreasing from the region of the branchia backwards ; the foot is narrower than the back. The *frontal* margin does not project far (about 1·2 mm.), it is slightly emarginate in the middle line ; on either side are from

[1] Several species hitherto described belong really to the genera *Idalia*, *Polycera*, and *Triopa*.

eight to ten frontal appendages, whose length is somewhat greater than the breadth of the frontal margin itself; the appendages are more or less arborescent, somewhat flattened and smoother on the under surface, they are irregularly bi- and tripinnate, the branches being mainly developed upon the margins of the stem; the terminal branches are elongated and conical, sometimes strongly drawn out; between the branches are frequently minute cones or branchlets; a number of small, simple, or tufted processes are often found between the main appendages of the frontal margin; close to the outer and hindermost of these is the round opening of the rhinophoria on either side with a slightly prominent unevenly notched margin.[1] The *rhinophoria* are strong; the shorter and more delicate stalk[2] is sharply marked off from the club, which was somewhat bent backwards; the rounded pyramidal club has about fifty broad thinnish leaves on either side, the short strong terminal papilla has an oval contour. The *head* is rather large; on either side is a *tentacle*, which has the appearance of a fold of the skin with a free lobe-like inferior extremity; its length is 2·5 mm., and its breadth at the base 1 mm.; on the anterior side of the free extremity there is, as in *Euplocamus japonicus*, an indistinct furrow. The mouth-tube in this specimen was retracted, and the short cylindrical labial disk (yellow in colour on account of the strongly developed cuticle) projected 2·5 mm.; at the rounded truncated anterior extremity was the narrow perpendicular *oral aperture*. From the hinder portion of the frontal margin runs on either side, along the edge of the back, a low fold as far as the root of the tail, in which it vanishes. From this dorsal margin arise on either side five *dorsal appendages*, of which the two hindermost are closest together; the rest being separated by nearly equal intervals, and placed each almost exactly opposite its fellow. The first was situated behind the region of the rhinophorion, the last at the junction of the back and tail. The dorsal margin between these appendages was somewhat undulating, and here and there prolonged into very small appendages.[3] These appendages exactly resembled those of the frontal margin, but had their branchlets more extended.[4] The hindermost appendage on either side was about double the size of the others, and formed of two appendages fused at the bases, of which the anterior was lower than the posterior. The *branchia* is formed of three broad and flattened tripinnate branches, the middle one being rather larger than the other two; from the base of the lateral branch, especially the left hand one, was given off outwards a strong branch; this indicates five branchial tufts as a number which is probably present in other individuals. The low truncated cylindrical anal papilla has a length of about ·6 mm., and entirely resembles that of other species of *Euplocamus*;[5] the margin of the opening is undulating; masses of food were projecting from the wide anal opening, and could easily be drawn out. At the base of the right

[1] Bergh, *loc. cit.*, p. 626, Taf. xi. fig. 9, *a*.
[2] *Loc. cit.*, fig. 9, *b*.
[3] *Loc. cit.*, Taf. xii. fig. 7.
[4] *Loc. cit.*, Taf. xi. fig. 11.
[5] *Loc. cit.*, Taf. xii. fig. 9.

hand gill tuft is the fine *renal pore*.[1] The dorsal surface itself was beset here and there with small points, which were also present upon the sides of the body, and especially upon the tail, on which they formed here and there villous processes. The *tail* has a dorsal keel. The genital papilla is large and lies beneath the right dorsal appendage; it has[2] two openings (præputium, vulva), surrounded by a common margin, and beneath the slit-like orifice of the duct of the mucous gland. The *foot* is of the same breadth throughout its whole extent, and only narrows behind at the tail, which gradually comes to a point; it stands out about 1·4 mm. from either side of the body; its anterior margin is straight, with projecting angles and a deepish furrow; the upper lip is split in the middle line.

The intestines were indistinctly visible on the back and sides of the body from the outside. The cavity of the body extended as far back as the region behind the last dorsal appendage. The peritoneum was colourless.

The *central nervous system* (Pl. IV. figs. 7, 8) is not much flattened; it is enclosed as usual in a (not very tight) capsule. The *cerebro-pleural* ganglia (figs. 7, *ab*, 8, *ab*) lie obliquely, their length exceeds their breadth, and the anterior is broader than the posterior portion; they are somewhat kidney-shaped, and the two parts of which they are made up are distinct from each other; the cerebral portion has a rounded contour, and is somewhat larger than the pleural. The *pedal* ganglia are oval (figs. 7, *c*, 8, *c*), and about as large as the cerebro-pleural. The nerve cells range up to ·25 mm. in diameter. At the base of the eye is a small sessile *optic* ganglion (fig. 7). The cerebral ganglia give off a *nervus tentacularis*, two *nervi labiofrontales*, and several *nervi retractorum bulbi*. The pleural ganglia give off a *nervus visceralis*, two *nervi palliales*, and the right a *nervus genitalis* in addition. The pedal ganglia give off two *nervi pediaei breves* and a single *nervus pediaeus longus*.[3] The *common commissure* (figs. 7, *d*, 8, *d*) is wide and strong; in the sheath it is composed of three separate commissures. The proximal *olfactory* ganglion (fig. 7, *ee*) is sessile and bulb-shaped, and about as large as the buccal; the distal ganglia are about the same size, oval in contour, and lie at the base of the rhinophoria; the *nervus olfactorius* is directed upwards, and pursues a winding course. The *buccal* ganglia (fig. 7, *f*) are round and planoconvex, and united with each other directly; they lie upon the strong band-like anterior part of the musculus transversus bulbi posterior superior; from each ganglion a strong *nervus lingualis posterior* takes its origin, from the outside of the *nervus lingualis superior*, which bifurcates immediately from the upper surface the *nervus œsophagealis*. A *gastro-œsophageal* ganglion I was unable to find.[4] At the base of the penis there was a round flattish ganglion of about ·25 mm. greatest diameter. I observed here and there portions of a *sympathetic system*, with minute ganglia.

[1] Bergh, *loc. cit.*, Taf. xii. fig. 9.
[2] *Loc. cit.*, Taf. xiii. fig. 2.
[3] *Loc. cit.*, p. 628.
[4] *Loc. cit.*, p. 629.

The *eyes* (figs. 7, 8) have an extreme diameter of about ·18 mm., and are sessile upon the optic ganglia; their pigment is black, and the lens pale yellow. The *otocysts* are nearly as large as the eyes, and lie close to them; they contain about 100 pale yellowish, round and oval otoconia, measuring up to ·02 mm. (fig. 9). The leaves of the rhinophorial club contain only a few hardened cells. A few generally rod-shaped spicules were present in the axis of the rhinophoria. In the skin were a great number of strong and hard spicules of very variable size and shape; their length reached about ·65–·8 mm., and their diameter ·02 mm.; the spicules were rod-like (Pl. III. fig. 30), regularly or irregularly cross-shaped, bifurcate at one or both ends (fig. 30), or six rayed (Pl. IV. fig. 10); the surface of the spicules was smooth or thickly covered (fig. 10) with fine points and tubercles. There were also large spicules in the dorsal and frontal appendages, but apparently none in the branchial leaves. In the interstitial connective tissue there were scattered here and there hardened cells, but no larger spicules.

The *mouth tube* appeared to be as usual. The *bulbus pharyngeus* is strong, compressed from before backwards, 4·2 mm. long by 3·5 broad and 3·5 high; the thick, short radula-sheath projects downwards about 1 mm. and is 8 mm. broad; the first half of the bulbus consisting of the labial disk, which resembles very much the collum uteri of the female; a little behind the middle of the bulbus is situated the usual circular furrow, somewhat emarginate above, in which is fastened the strong *retractor bulbi*. The muscular apparatus of the bulbus appeared to be as usual.[1] The *labial disk*, as above mentioned, is large and strong; on the anterior margin is an oval perpendicular groove in which lies the perpendicular mouth slit, within which is visible the yellowish-brown margin of the labial plates. The labial disk is covered by a strong yellow cuticle, which is radially striate in the neighbourhood of the groove already mentioned; near the internal margin it is darker, and appears under the microscope to be rather destroyed. On the inner side of the anterior part of the buccal cavity, reaching to the margin of the mouth-slit, there is on each side the strong chestnut-coloured[2] (brownish-black in the anterior inferior margin) labial plate (figs. 11, 12). Both plates are separated above and below by a furrow; the anterior cutting edge of the left is sharper, and comes beyond the right hand one. The plates have a rounded triangular contour, the greatest diameter is 1·9 mm.; towards the posterior margin they become thinner, elsewhere they are about ·6 mm. thick (fig. 12); the posterior thinner margin is nearly perpendicular, inclined a little obliquely backwards; the thicker under portion runs horizontally forwards, it has a broad longitudinal furrow; the convex anterior margin is the thickest, it thins off a little towards the upper angle; on the right plate (fig. 12) the margin falls off obliquely (fig. 12), and is slightly excavated along its length; on the left the inner half of the margin is strongly flattened and slopes behind; the corners are rounded (fig. 11), the posterior inferior especially; the attached outer surface is arched from above downwards, and a

[1] Bergh, *loc. cit.*, p. 630.

[2] Colour of the fruit of *Æsculus hippocastanum*.

little excavated in the direction of the long axis; the free inner side is perfectly smooth under the microscope, and is somewhat concave in height and length, especially in the hinder half, from which the anterior half stands off like a special facette. More minute investigation showed the plates to be of a dense and finely striated structure, in which, however, there was no trace of any rods (as in *Euplocamus croceus* and *japonicus*[1]). The *tongue* is very large, somewhat flattened, covered as far as the radula with a thick, tough, whitish cuticle; the cleft is deep, rather wide, and covered at its sides by the yellowish radula, and closed behind by the keel-shaped projecting lingula. The structure of the organ appeared to agree with that of *Euplocamus croceus.*[2] The rhachis of the radula was divided into areas by furrows (fig. 13), and with strong arches formed of closely-pressed furrows lying behind each other, and separated by intervals. At the point of the tongue there were several similar arches and furrows, which appeared to indicate that several rows of teeth had formerly been present, but were now rubbed off. The *radula* had ten or eleven rows of teeth, but further back, within the radula-sheath, there were but three fully developed and two undeveloped series; the total number was thus about sixteen The first two or three rows were incomplete, and the large teeth upon them were evidently worn. Each row had two large lateral (fig. 13, *ab*), and, at any rate in the young series, six external teeth (fig. 13, *cc*). The *lateral plates* were rather like each other, the innermost (figs. 13, *aa*, 14, *a*, 15, *a*) somewhat smaller than the outer ones (figs. 13, *bb*, 14, *b*, 15, *bb*). The basal portion of these lateral plates is flattened and obliquely truncate behind; from the outer margin arises obliquely a strong compressed crest, rounded above; in front the basal portion is continued into the incurved hook, the apex of which is rather flat (figs. 13, 14). The *outer row of teeth* joins the hinder half of the base of the second lateral plate (fig. 13, *cc*). There were five of these external teeth in the middle of the tongue and six elsewhere. The innermost of these (figs. 16, 18, *aa*) has just a trace of the terminal hook, and is larger than the others, which otherwise resemble each other; they are longish, a little depressed, but hardly perceptibly broader than high; the under surface is narrower than the upper, which slopes outwards, the inner margin being more bulged forward (figs 16–18). The teeth were all yellowish, the large side plates rather darker in their thicker portions. The length of the inner lateral plates (on the root of the tongue) was about ·5 mm., their height about ·3 mm.; the outer lateral plates usually ·6 mm. in length by ·4 mm. in height; the length of the innermost outer tooth was ·28 mm. in length and ·08 in height; the succeeding one measured ·22 mm. in length, the third ·2, the fourth ·18, the fifth ·16, and the sixth ·14 mm. The tissue of the radula-pulp contained a number of large odontogenous cells behind the younger series of teeth.

The *salivary glands* were smaller, and did not extend so far back as in *Euplocamus croceus*;[3] they were yellowish-white in colour; the efferent ducts rather short.

[1] Bergh, *loc. cit.*, Taf. xi. fig. 12; Taf. xii. fig. 14. [2] *Loc. cit.*, p. 630. [3] *Cf.* Bergh, *loc. cit.*, p. 632.

The *œsophagus* was short, with fine longitudinal folds on the inner surface. The *stomach* large, 8 mm. long, about 4 mm. in diameter, lying on the upper side of the posterior end of the bulbus pharyngeus and of the anterior genital mass, the hinder portion covered by the angle of the gut. The inside of the stomach had longitudinal folds; into the hinder portion opens the short wide bile duct. The *intestine* beside this latter perforates the liver and runs in a fine groove on its surface, forms an angle, and is then directed towards the foot, and runs finally to the anal papilla along a superficial groove in the liver. The inside of the intestine has fine longitudinal folds. The length of the intestine was 2·5 cm., the diameter from 1·5–2·5 mm. The contents of the whole alimentary tract were a soft mass, which appeared to consist mainly of Bryozoa (reminding one of *Crisidia*, Milne-Edwards).

The *liver* is nearly heart-shaped, with the broad end directed anteriorly; two facets are formed upon it by the anterior genital mass, and from about the middle beneath and somewhat to the right, arises the main bile duct; the hinder portion is rounded; the circumference is also rounded, the under side only a little flattened. On the upper side is the shallow furrow for the first portion of the intestine; on the right side, anteriorly, is the obliquely-directed furrow of the hinder portion of the intestine, running upwards, and ending in the neighbourhood of its appearance on the surface of the liver. The colour of the liver substance is dirty yellowish; the upper surface, owing to the presence of the hermaphrodite gland, is clearer. The length of the organ is 1 cm., the breadth and height (of the anterior portion) about 9 mm. Its cavity is wide; on the walls are fine, generally perpendicular, folds; beneath the main bile duct, and on the right, is a broad round bile opening; on the lower wall are several smaller openings. The contents of the liver were the same as those of the rest of the alimentary tract. The *gall-bladder* was on the right side of the pylorus, dirty yellow in colour, about 4 mm. high.

The *pericardium* was situated at the anterior end of the liver, resting on the gut. The ventricle of the *heart* measured 2·5 mm. in length; the atrium very large. The *blood gland* lies behind the central nervous system, and somewhat obliquely upon the stomach; it is strongly flattened, and has a greatest diameter of about 4 mm.; it is lobulate at the margin and whitish in colour.

The *renal syrinx* is yellowish-white, about 1 mm. long, and pear-shaped. The *urinary chamber* and the *kidney* appeared to resemble those of the typical species.[1]

The *hermaphrodite gland* clothes the liver all round with a thinnish layer, about ·3 mm. thick, being absent only at the anterior part of the hinder visceral mass in the region of the bile duct; it is yellowish-white in colour, and has the usual structure, the small yellowish ovarian follicles covering the greyish testicular follicles; the gonoblasts are ripe. The hermaphrodite duct takes its origin above the main bile duct; it is thickish, and rapidly dilates into the ampulla.—The whitish *anterior genital mass* is

[1] Bergh, *loc. cit.*, p. 634.

planoconvex; the hinder surface has two facets, one on the left, which is the larger, and another on the right; the anterior surface is convex; the upper margin rather flattened, the other sharp; the length of the mass from before backwards reached 4·5 mm. by 8·5 mm. in breadth and 7·5 mm. in height; the chief efferent ducts project 2 mm. Along the upper margin runs the *vas deferens*, forming several loops and then running straight; on the posterior side the vaginal duct is directed upwards from the spermatheca; on the under side, between the mucous gland and the prostate, is the chocolate-grey ampulla. The largest portion of the genital mass is formed by the prostate, showing a number of cells and holes glimmering through. The sausage-shaped, somewhat curved chocolate-grey ampulla, is about 5 mm. long by 1·5 mm. in diameter. The female branch of the hermaphrodite duct opens in or in the neighbourhood of the albuminiparous gland;[1] and the uterine duct of the spermatheca (fig. 23, *d*) also communicates with it. The *spermatheca* (fig. 23, *a*), with the exception of the region of the ducts, is quite covered by the prostate; it is pear-shaped, and 5·5 mm. in length, yellowish in colour, and filled with semen and detritus. Its main external duct, the *vaginal duct* (fig. 23, *b*), is thinner, and has a rather straight course; it then increases to three or four times its diameter, and ascends, bending outwards, to the genital papilla (fig. 23*c*); the whole length of the duct is about 8 mm., of which nearly one-half belongs to the vagina, which is rather thick-walled with longitudinal folds within. The other, the *uterine duct* (fig. 23, *dd*), rises near the last, but is thinner, and forms a descending loop; when stretched to its full length it measures about 10 mm.; at about the junction of its middle and posterior third is the *spermatocyst*. This last (fig. 23, *e*) is short and pear-shaped, 1·4 mm. long; whitish in colour and filled with semen, it lies beneath the vas deferens, and upon the upper margin of the anterior genital mass; its thin duct is about as long again as the bladder. The *male branch*,[2] which takes its origin from the hermaphrodite duct, is short, and immediately enters the *prostate*, which is very large, and together with the included spermatheca occupies about four-fifths of the entire anterior genital mass; it is whitish, with an even upper surface; the prostatic layer reaches a thickness of 1–1·8 mm. on the posterior side of the spermatheca. From the upper side of the left hand end a small, somewhat flattened, thin-walled prolongation (fig. 24, *a*), about 4 mm. long, issues; it is the *vas deferens;* it then narrows and forms a loop, and runs in a straight course to the genital papilla; this last muscular whitish-coloured part of the vas deferens is about 1 cm. in length (fig. 24, *b*); at the end it is wider, and forms the præputium *penis*, which has a length of about 1 mm., and at the base of which is the round aperture of the retracted glans. That portion of the vas deferens which is provided with hooks is quite 7 mm. long; the hooks appeared to be arranged in twenty to twenty-five irregular longitudinal rows (forming quincunces ?), the number of rows behind appeared to be hardly greater than in front. The *hooks* (figs. 20–22) are of a yellowish colour; their size is variable, the greatest length being ·13 mm.

[1] Bergh, *loc. cit.*, Taf. xiii. fig. 13.

[2] *Loc. cit.*, Taf. xiii. fig. 13, *i*.

(fig. 20); behind they are rather smaller, hardly exceeding ·1 mm. in length (fig. 21). Their base of attachment is of a rounded triangular form, from which the spine arises more or less obliquely (fig. 22); the spinal portion is awl-shaped, and is more usually curved than straight; occasionally abnormal forms arise (fig. 22), by the division of one or the fusion of the neighbouring spines. The axis of the basal portion of the larger spines is finely granulate, sometimes it is granulate through a larger extent (fig. 22). The white *mucous gland* with its fine windings forms the right portion of the anterior genital mass; on the hind portion of its left side is the clear yolk-yellowish *albuminiparous gland;* the *duct* of the mucous gland has the usual strong longitudinal fold.

This species differs in the armature of the tongue from the two other species which the genus contains; these have three large lateral teeth, while this species has only two; it has also a smaller number of outer teeth (five or six) than the others (eighteen or thirty-five). There are also some essential differences in the details of the generative system.

Sub-family 2. Dorididæ Cryptobranchiatæ.

Chromodoris, Alder and Hancock.

Chromodoris, Alder and Hancock, Monogr. Brit. Nudibr. Moll., pt. vii., 1855, p. xvii.
„ Bergh, Neue Nacktschnecken der Südsee, III., Journ. d. Mus. Godeffroy, Heft viii., 1875, pp. 72–82; Heft xiv., 1878, pp. 1–50.
„ idem, Untersuch. d. Chromodoris elegans u. villafranca, Malacozool. Blätter, Bd. xxv., 1878, pp. 1–36.
„ idem, Neue Chromodoriden, Malacozool Blätter N.F., Bd. i., 1879, pp. 87–116.
„ idem, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft xi., 1877, pp. 464–494; Supplementheft i., 1880, pp. 14–27; Heft ii., 1881, pp. 81–85.
„ idem, Beitr. zur Kenntn. d. japan. Nudibr. II.; Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxxi., 1881, pp. 219–222.
„ H. v. Jhering, Beitr. zur Kenntn. d. Nudibr. d. Mittelmeeres, Malacozool. Blätter, N.F., Bd. ii., 1880, pp. 1–56; Taf. i.–iii.

Forma corporis fere ut in Goniodoridibus, sed colores hilares, sæpe magnifici, ut plurimum striati vel maculati. Branchia (retractilis) foliis simpliciter pinnatis.

Armatura labialis e hamulis minutis confertis composita. Radula rhachide nuda, pleuris multidentatis. Dentes hamati, primi utroque latere hami denticulati, reliqui externo solum; extimi humiles, apice denticulati.—Penis inermis.

The genus *Chromodoris* was first established, though on insufficient grounds, in 1854, by Alder and Hancock.[1] Ten years later the same authors[2] gave a more accurate

[1] Alder and Hancock, Monogr. Brit. Nudibr. Moll., pt. vi., 1854, Fam. 1, pl. xvii., Gen. 2 (*Goniodoris*, F.).

[2] Alder and Hancock, Notice of a collection of Nudibranchiate Mollusca made in India, *Trans. Zool. Soc. Lond.*, vol. v., part 3, 1864, p. 123.

and sufficient description of its characters. The genus *Goniobranchus* of Pease,[1] I am inclined, from an examination of his typical species, to consider identical with *Chromodoris*. The genera *Glossodoris*, *Actinodoris*, and *Pterodoris* of Ehrenberg, established in 1831, differ only in unessential and inconstant characters of the branchia, and hence must be incorporated with *Chromodoris*.[2] The genus *Doriprismatica* of d'Orbigny, established in 1834, must also be regarded as merely a variety of *Chromodoris*.

I have of late years examined a great number of species of this genus.

Chromodoris, in form and outward characters, resembles rather closely the very different *Goniodoris*, and on this account the two genera have been frequently confused; but the *colour*, even, is quite different.

The tentacles are small and conical; the retractile rhinophoria have a perfoliated club. The edge of the mantle is prominent, and usually forms a frontal and caudal veil. The retractile *branchia* is formed of simply pinnate leaves. The *armature of the labial disk* is strong, and composed of a number of densely-set small hooks, bifid at the tip. The radula contains no rhachidian teeth, but there are frequently thickenings which take their place. The lateral teeth are numerous and hook-shaped; the first lateral tooth is denticulate on both sides, the rest denticulate only upon the external margin; the outward teeth are smaller, and denticulate at the extremity. The penis is unarmed.

The genus *Chromodoris* is readily distinguished by its external characters from *Casella;* from *Aphelodoris* it differs by the armed condition of the labial disk, and by the characters of the branchia. As far as is known at present, the genus is confined to the tropics, or at least the warmer seas, and is the most abundant genus of the Family Dorididæ. Practically nothing is known concerning its habits and development.[3]

The following is a list of the known species:—

1. *Chromodoris zebrina*, Alder and Hancock.
   Indian Ocean.

2. *Chromodoris elisabethina*, Bergh.
   ? Doris quadricolor, Leuckart.
   ? Actinodoris sponsa, Ehrenberg.
   Philippine Sea.

3. *Chromodoris annæ*, Bergh.
   Philippine Sea.

[1] *Amer. Journ. of Conch.*, vol. ii., 1866, p. 204.

[2] Bergh, Kritische Untersuch. d. Ehrenberg'schen Doriden, *Jahrb. d. deutsch. malakozool. Gesellsch.*, Bd. iv., 1877, pp. 52–58.

[3] Pease, *Amer. Journ. of Conch.*, vol. vii., 1871, pp. 15, 19.

4. *Chromodoris striatella*, Bergh.
Philippine Sea.

5. *Chromodoris gloriosa*, Bergh.
? Doris dorsalis, Gould.
Pacific Ocean.

6. *Chromodoris scurra*, Bergh.
Pacific Ocean.

7. *Chromodoris histrio*, Bergh.
Pacific Ocean.

8. *Chromodoris luxuriosa*, Bergh.
Pacific Ocean.

9. *Chromodoris lemniscata* (Quoy et Gaimard).
Indian Ocean (Isle de France).

10. *Chromodoris lineata* (Souleyet).
Pacific Ocean.

11. *Chromodoris magnifica* (Quoy et Gaimard).
Pacific Ocean (New Guinea).

12. *Chromodoris whitei* (Adams and Reeve).
Chinese Sea.

13. *Chromodoris trilineata* (Adams and Reeve).
Chinese Sea.

14. *Chromodoris marenzelleri*, Bergh.
Japanese Sea.

15. *Chromodoris bainardi* (Kelaart).
Japanese Sea.

16. *Chromodoris villafranca* (Risso).
Doris pulcherrima, Cantraine.
Doris tenera, O. G. Costa.
Doris scacchi, delle Chiaje.
? Doris pasinii, Verany.
Mediterranean.

17. *Chromodoris cantrainii*, Bergh.

Goniodoris elegans, Cantraine.
Doris picta, Schultz.
Doris schultziana, delle Chiaje.
Doris villafranca, delle Chiaje.
Doris nardii, Verany.
Doris calcaræ, Verany.
? *Doris infucata*, Rüppell und Leuckart.
? *Doris lutescens*, delle Chiaje (Verany).
? *Doris valenciennesii*, Cantraine.
? *Doris marmorata*, Savigny.

Mediterranean.

18. *Chromodoris cærulea* (Risso).

Doris tricolor, Cantraine.

Mediterranean.

19. *Chromodoris gracilis* (delle Chiaje).

Doris gracilis, Rapp.

Mediterranean.

20. *Chromodoris messinensis*, v. Jhering.

? *Doris villæ*, Verany.

Mediterranean.

21. *Chromodoris albescens* (Schultz).

? *Doris pirainii*, Verany.

Mediterranean.

22. *Chromodoris luteo-rosea* (Rapp).

var. *Chromodoris jheringi*, Bergh.
? *Doris parthenopeia*, delle Chiaje.

Mediterranean.

23. *Chromodoris elegantula* (Philippi).

Mediterranean.

24. *Chromodoris krohnii* (Verany).

Mediterranean.

25. *Chromodoris purpurea* (Risso).

? *Doris pallens*, Rapp.

Mediterranean.

26. *Chromodoris orsini*, Verany.
? Goniodoris cœlestis, Deshayes.
Mediterranean.

27. *Chromodoris mörchii*, Bergh.
Goniodoris picturata, Mörch.
West Indies.

28. *Chromodoris decora* (Pease).
Pacific Ocean.

29. *Chromodoris marginata* (Pease).
Pacific Ocean.

30. *Chromodoris lineolata* (van Hasselt).
Indian Ocean, Java.

31. *Chromodoris alba* (van Hasselt).
Indian Ocean.

32. *Chromodoris dorsalis* (Gould).
Pacific Ocean.

33. *Chromodoris runcinata*, Bergh.
Philippine Sea, Pacific.

34. *Chromodoris semperi*, Bergh.
Philippine Sea.

35. *Chromodoris paupera*, Bergh.
Philippine Sea.

36. *Chromodoris verrucosa* (Crosse).
Pacific Ocean.

37. *Chromodoris erinaceus* (Crosse).
Pacific Ocean.

38. *Chromodoris virginea*, Bergh.
Philippine Sea.

39. *Chromodoris obsoleta* (Rüppell und Leuckart).
Red Sea.

40. *Chromodoris tinctoria* (Rüppell und Leuckart).
Red Sea.

41. *Chromodoris pulchella* (Rüppell und Leuckart).
Red Sea.

42. *Chromodoris pallida* (Rüppell und Leuckart).
Glossodoris xantholeuca, Ehrenberg.
Red Sea.

43. *Chromodoris variegata*, Pease.
Pacific Ocean (Tahiti).

44. *Chromodoris maculosa*, Pease.
Pacific Ocean (Tahiti).

45. *Chromodoris tryoni* (Garrett).
Pacific Ocean.

46. *Chromodoris rufo-maculata*, Pease.
Pacific Ocean (Huaheine Islands).

47. *Chromodoris pustulans*, Bergh.
Philippine Sea.

48. *Chromodoris simplex*, Pease.
Pacific Ocean (Maiao Islands).

49 *Chromodoris albo-maculata*, Pease.
Pacific.

50 *Chromodoris albo-notata*, Bergh.
Pacific.

51. *Chromodoris inornata*, Pease.
Pacific.

52. *Chromodoris lentiginosa*, Pease.
Pacific (Huaheine Islands).

53. *Chromodoris varians*, Pease.
Pacific.

54. *Chromodoris pulchra*, Pease.
Pacific.

55. *Chromodoris vibrata*, Pease.
Pacific.

56. *Chromodoris propinquata*, Pease.
Pacific.

57. *Chromodoris picta*, Pease.
Pacific.

58. *Chromodoris bennetti* (Angas).
Pacific.

59. *Chromodoris loringi* (Angas).
Pacific.

60. *Chromodoris mariei* (Angas).
Pacific (New Caledonia).

61. *Chromodoris splendida* (Angas).
Pacific.

62. *Chromodoris daphne* (Angas).
Pacific.

63. *Chromodoris festiva* (Angas).
Pacific.

64. *Chromodoris albo-pustulosa*, Pease.
Pacific.

65. *Chromodoris crossei* (Angas). n. gen. ?
Pacific.

66. *Chromodoris pusilla*, Bergh.
Pacific.

67. *Chromodoris punctulifera*, Bergh.
Pacific.

68. *Chromodoris montrouzieri* (Crosse).
Pacific.

69. *Chromodoris elegans* (Quoy et Gaimard).
Pacific.

70. *Chromodoris citrina*, Bergh.
Pacific.

71. *Chromodoris verrieri* (Crosse).
Pacific (New Caledonia).

72. *Chromodoris lamberti* (Crosse).
Pacific (New Caledonia).

73. *Chromodoris petiti* (Crosse).
Pacific (New Caledonia).

74. *Chromodoris souverbiei* (Crosse).
Pacific (New Caledonia).

75. *Chromodoris smaragdina* (Gould).
Pacific.

76. *Chromodoris picturata* (Ehrenberg).
Red Sea.

77. *Chromodoris erythræa* (Ehrenberg).
Pacific.

78. *Chromodoris pallescens*, Bergh.
Pacific.

79. *Chromodoris camoena*, Bergh.
Pacific.

80. *Chromodoris thalassopora*, Bergh.
Pacific.

81. *Chromodoris lapinigensis*, Bergh.
Pacific.

82. *Chromodoris pantharella*, Bergh.
Pacific.

83. *Chromodoris dalli*, Bergh.
East Pacific.

84. *Chromodoris californiensis*, Bergh.
East Pacific.

85. *Chromodoris reticulata* (Pease).
Pacific.

86. *Chromodoris godeffroyana* (Pease).
Pacific.

87. *Chromodoris glauca*, Bergh.
Pacific.

88. *Chromodoris gonatophora*, Bergh.
West Indies.

89. *Chromodoris rudolphi*, Bergh.
Pacific (Island of Tonga).

90. *Chromodoris maccarthyi* (Kelaart).
Indian Ocean.

91. *Chromodoris pretiosa* (Kelaart).
Indian Ocean.

92. *Chromodoris fidelis* (Kelaart).
Indian Ocean.

93. *Chromodoris cardinalis*, Bergh.
Pacific (Tonga).

94. *Chromodoris peasei*, Bergh.
Doriprismatica lineata, Pease.
Pacific (Sandwich Islands).

95. *Chromodoris mollita*, Abraham.
Locality unknown.

Chromodoris striatella, Bergh (Pl. III. figs. 26–29; Pl. IV. figs. 1–4).

Chromodoris striatella, Bgh., Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.) Heft vi., 1874, Tab. xxxiii. fig. 4; Heft xi., 1877, p. 474–478, Tab. li. figs. 24–25.

„ Idem, Neue Nacktschnecken d. Südsee. Journ. Mus. Godeffr. Heft viii. 1875, p. 73; Heft xiv., 1878, p. 5.

? *Doris lineolata*, van Hasselt, Extrait d'une lettre du Dr. J. C. van Hasselt au Prof. van Swinderen sur les Mollusques de Java, Bull. d. Sci. Nat. et de Zool., t. iii., 1824, p. 258.

Color fundamentalis brunnescens, sed ubique fere lineolis flavescentibus depulsus, pallii margine citrino; rhinophoria et branchia rubra punctulis nigris.

Habitat.—Philippine Sea (Burias, Masinloc), Pacific (Port Denison, Torres Strait).

Of this species three examples were taken on September 8, 1874, in Torres Strait, Station 186, lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; bottom, coral sand.

They were well preserved in alcohol. The length reached to between 2 and 3 cm., the breadth 11 or 13 mm., and the height 7 to 8·5 mm.; the breadth of the foot 3·5–5 mm., the breadth of the margin of the mantle 2–2·5 mm.; the height of the rhinophoria 2·5 mm., of the branchia 3·5 mm.

The *colour* of the animal, preserved in spirit, is black or velvet black; on the dorsal surface of the mantle edge are a number of yellowish-white lines running parallel with it, variable in size and in number; in front the number is somewhat smaller than behind, where it is mostly from about six to eight. The dorsal surface proper is traversed by a number of similar lines, which are more or less continuous, and branch and anastomose; the margins of the mantle and of the foot are yellowish-white in colour; the under surface of the mantle edge, and the sides of the body as far as the margin of the foot, are covered with similar but stronger (8–14) lines, a variable number of which are prolonged onwards over the tail. The margin of the rhinophorial aperture is whitish; the stem of the rhinophoria blackish-grey, the club yellowish, with white points on the edges of its leaves. The margin of the branchial cavity is surrounded by radially arranged white lines; the branchial leaves at the root and along the chief rhachis are entirely of a blackish-grey colour, but the leaves themselves are yellowish, sprinkled with whitish-yellow points. The anal papilla (and its neighbourhood) are spotted with black, whitish at the end; the sole of the foot is yellowish, the tentacles white, the neighbourhood of the mouth yellowish-grey. The genital papilla is whitish.

The *form* of the body is as usual. The club of the rhinophoria has from thirty to twenty-five leaves. The diameter of the roundish branchial cleft about 4 mm.; the branchia is rolled into a spiral at both ends; each half is formed of nine leaves, of which the five hindermost are smaller and simply feathered, the others are larger and are divided

above into 2–4 branches, each of which is simply feathered. The anal papilla between the rolled-up ends of the branchia is about as high as the branchial leaves, cylindrical in form, and a little thicker above, and with a round-indented opening. On the right hand side is the wide renal pore.

The largest specimen was carefully dissected. The pericardium was of a chocolate-brown colour, as also the part of the peritoneum covering the blood glands.

The *central nervous system* was difficult to investigate, as it lay in a strong sheath of connective tissue. The cerebro-pleural ganglia were reniform, with arched surfaces; the two divisions very distinct, the hindermost larger than the foremost. The pedal ganglia lying outside the pleural are a trifle smaller than these, and plano-convex in form. The common commissure is narrow, hardly longer than the diameter of the central nervous system; the three commissures of which it is composed are clearly distinguishable, and of these the hindermost is partly free from the other. The proximal olfactory ganglia are sessile and bulb-shaped, the distal somewhat smaller and pear-shaped. The buccal ganglia (Pl. IV. fig. 1, *aa*) are a little larger than the proximal olfactory ganglia and plano-convex, they are united by a short commissure; the gastro-œsophageal ganglia are short-stalked and small, they are situated on the outer side of the nerve, they are not more than one-tenth of the size of the buccal ganglia (fig. 1, *bb*).

The *eyes* are short-stalked, the pigment is black, the lens yellow. The *otocysts* are rather smaller than the eyes, with about 200 otoconia of the usual kind. The walls of the cavity of the stalk and of the club of the *rhinophoria* are covered with greyish-black pigment.

The *mouth tube* is strong, 3·5 mm. long, whitish-yellow in colour; the inferior and median pairs of retractor muscles are very long; its interior is as usual. The *bulbus pharyngeus* is strong, 3·5 mm. long, by about 3 mm. in height, and 3·5 mm. in breadth; the radula-sheath projects about ·5 mm. below. The arched labial disk surrounds the perpendicular mouth slit, which is provided with a continuous dark yellowish coloured armature, which, especially below, but also above, passes over a portion of the labial disk. This *prehensile ring* is interrupted neither above nor below; above it is a trifle narrower, being below about 1·2 mm. broad. The ring, as usual, is formed of densely set straight or somewhat curved yellow rods, about ·06 mm. in height, which are bifurcate (Pl. III. fig. 26) at their upper extremities. The *tongue* is broad, with a deep cleft, which is covered up over its margins by the clear yellow-coloured radula; in this last are forty-two *series of teeth*, further back thirty-two developed and four not fully developed series; the total number thus is seventy-eight. The first eleven rows are more or less incomplete; on the middle of the tongue are about fifty-eight teeth on each side, at its base sixty, and the number increased passing backwards to sixty-two or sixty-three. In the very narrow rhachis, corresponding to the hinder end of the body of the innermost teeth (fig. 27, *a*), there are small, quite colourless thickenings of the cuticle, cleft at their hinder extremities.

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The teeth are clear yellow coloured. The length of the innermost of them measures about ·04 mm., increasing gradually to ·17 mm., then decreasing towards the exterior, the four outermost measuring ·09–·08, ·075 or ·05 mm. The innermost teeth have from one to two denticulations on the inner side of the hook, and about four upon the outer side (fig. 27, *bb*). Throughout the row of teeth the length of the hook gradually increased, but decreased at the outermost portion; the length of the basal portion, on the contrary, only increased very little, and decreased again in the outermost portion of the row. All the teeth were denticulated along the outer margin almost as far as the end of the hook (Pl. III. fig. 29; Pl. IV. fig. 2); the smooth bent termination had quite disappeared in the outermost one to three teeth (figs. 28, 29). The number of denticulations was usually from seven to nine, sometimes eleven to twelve; on the innermost five to eight teeth they were fewer in number, mostly four or five; also in the outermost five or six were commonly seen; there were, however, several of the outermost teeth with only eleven or twelve of the finest denticulations (fig. 29, *a*). There were also several quite smooth teeth.

The *salivary glands* are of considerable extent, and whitish in colour, about 12 mm. long by ·3–·5 mm. in thickness; they pass backwards from the bulbus beneath the anterior genital mass, and are attached to the liver; they run side by side in the middle line, and frequently wind round each other. The efferent ducts are short.

The *œsophagus* is about 2·5 mm. broad by 8 mm. in length, on the inner surface are strong longitudinal folds; it opens into the cavity of the liver by a wide circular opening, which here appears to act as a *stomach;* it was filled with the débris of food. Behind the middle of the upper left hand wall is the round opening into the *intestine*, which in its anterior part is about 9·5 mm. long; it increases in width posteriorly up to 2·5 mm., and then narrows to about 2 mm.; the posterior half has a length of about 15 mm., by a diameter of 1·2 mm. Its interior has numerous fine longitudinal folds. The contents of the intestinal tract were indistinguishable animal remains.

The *liver* is 9 mm. long by 7·5 mm. in breadth, and 6·5 mm. in height; the anterior portion is broad, obliquely cut off behind and on the right, with a deep median cleft for the œsophagus; the somewhat narrower hinder end is rounded; on the left of the anterior half of the upper side is a broad furrow for that portion of the intestine which runs forward; on the right hand is a narrower furrow for the portion directed backwards; the colour of the (upper part of the liver) is brownish-grey; its interior yellowish-white. The *gall-bladder* is large and sac-like, 2·5 mm. in diameter; lying in front of the base of the intestine and beneath it, opening by a short duct.

The *pericardium* is large. The chamber of the heart (Pl. IV. fig. 3, *b*) about 2 mm. long. The *blood glands* cover the central nervous system; they are whitish, very flattened, irregularly-oval, and lobulate on the margin; the anterior is 3 mm. thick, the hinder 4 mm. The urinary chamber (fig. 3) forms a deep cleft, with a round lumen, with numerous thicker or thinner ridges and partition walls at the sides, which are visible through the thin upper

wall, to which is fixed the aorta. The chamber commences at the hinder end of the liver, and extends a little in front of its anterior boundary; it is covered on either side by the masses of renal tissue (fig. 3, *dd*), which do not exceed 1·5–2 mm. in breadth, except in the anterior and posterior extremities, and are of a yellowish colour within, changing to white upon the outside; they are traversed from within outwards by prolongations of the clefts lying on the side walls of the urinary chamber; the cavities appear more or less distinctly through its walls, and are round or somewhat angular in form. Behind is the simple opening of the duct of the renal syrinx (fig. 3), just beside the ascent of the vena hepatica magna to the branchia, and of the intestine to the anal papilla, and the continuation of the urinary chamber ascends as a urethra to the renal groove. The *renal syrinx* (fig. 3) is bulb-shaped, of ·75 mm. greatest diameter; the folds of the interior can easily be seen from the outside; the ciliated cells are as usual. The duct of the renal syrinx is about 1·5 mm. long, opening into the chamber; in the interior are the usual villi and papillary outgrowths.

The sexual products in the *hermaphrodite gland* were hardly developed. Thus the *anterior genital mass* was not large, 4·5 mm. long, 1·5 mm. broad, and 3·5 mm. high; the main efferent ducts, moreover, projected 1 mm. The whole genital mass is yellowish in colour. The ampulla of the hermaphrodite duct lies in many coils, when unrolled it is about 1 cm. long by ·4 mm. diameter. The long vas deferens is considerably thinner than the ampulla, and covers it for the most part with numerous windings; its length, when unrolled, is about 1·4 cm.; below it is much thinner and passes into the penis, which is thicker, and reaches a length of 2 mm. The last-mentioned organ (præputium) is provided with a small papilla at the bottom of its cavity. The spherical *spermatheca* (fig. 4, *a*) is about 1·5 mm. in diameter; the vaginal duct (fig. 4, *b*) is about a half longer than the receptaculum seminis, below it is somewhat enlarged, and forms the vagina; the uterine duct (fig. 4, *c*) is much thinner; close by its origin is the short-stalked sausage-shaped *spermatocyst* (fig. 4, *d*), which has a length about equal to that of the spermatheca. Both receptacula seminis were filled with detritus. The *mucous gland* is heart-shaped, somewhat compressed; on its outside, at the posterior end, a part of the yolk-yellow albuminiparous gland was laid bare. The duct of the mucous gland is provided with the usual fold.

Chromodoris runcinata, Bergh (Pl. VI. figs. 1–4).

> *Chromodoris runcinata*, Bergh, Malacolog. Untersuch., *loc. cit.*, Heft xi., 1877, pp. 479–481, Taf. li. figs. 32–33, Taf. liii. figs. 5–12.

Habitat.—Pacific Ocean (Port Jackson).

A single specimen was dredged in company with *Rizzolia australis* at Port Jackson, on the 17th of April 1874, from a depth of 2 to 10 fathoms.

It was very much hardened, and measured 14 mm. long by 8 in breadth and 6 in height. The *colour* was, as usual, bluish or bluish-grey, covered with quite small white spots on the back and sides, and numerous larger bluish-black spots; upon the mantle edge were some of these larger still, and mostly arranged in a row, occasionally alternating with rather larger white ones; the margin of the foot was similar in this respect to the mantle edge; the branchia and rhinophoria were bluish-green; the tentacles and sole of the foot yellowish-grey.

The shape of the body as usual. The tentacles were retracted and inverted. The rhinophoria had each about thirty leaves. The edge of the mantle stands out about 2 mm. The caudal veil is somewhat wider. At the anterior portion of the *lateral margins* are found the usual small *conical bodies* which are also present on the hinder margin in the region of the branchia, but are stronger. The branchia has about twelve leaves, forming a circle, which are like those previously mentioned. The sides of the body and the foot I have already described.

The cerebro-pleural *ganglia* are thick, the pedal rather more flattened; the three commissures within the common sheath are quite distinguishable. The inferior olfactory ganglia are quite sessile and bulb-shaped; the upper are smaller and spherical. The buccal ganglia are a trifle larger than the inferior olfactory ganglia, round in shape, and directly united to each other. The gastro-œsophageal ganglia in this specimen were spherical, and hardly one-tenth of the size of the preceding pair; they are developed on the side of the nerve. The eyes and otocysts I have already described. The cavity of the rhinophoria was of a bluish-green colour, and contrasted with the white nerves.

The *mouth tube*, both inside and outside, was of a bluish-green, especially in the anterior region. The *bulbus pharyngeus* was 2·5 mm. long, and of a yellowish-white colour. The *labial disk* was broad, and greenish-yellow in colour, forming a ring which was only broken in the middle line, and formed of the usual elements (Pl. VI. fig. 1). The *tongue* was short and broad; its clear yellowish-green radula contained thirty series of teeth; behind twenty-eight developed and four undeveloped series; the total was therefore sixty-two. In the twentieth series of the tongue there were from ninety-four to ninety-six teeth on either side.[1] On the narrow rhachis, as in many other species of *Chromodoris*, were small colourless bifid thickenings, which might easily be altogether passed over. The *teeth* (fig. 3) are yellowish in colour; the hook is cleft at its extremity in almost all the series; on the inner margin of the hook of the innermost tooth is a strong denticle; in the outermost teeth (fig. 2) the bifurcation of the extremity is less conspicuous, and the outer margin of the hook irregularly denticulate and the denticles larger in size; in the other teeth there were often seen a few small denticles or tubercles.

The *salivary glands* are flattened and ribband-shaped, generally crenate at the

[1] In the earlier specimens investigated by me there were fifty-four to fifty-eight series, and about seventy-two teeth in each series.

margins, white in colour, broader (·75 mm.) in front than behind, and about 1 cm. long; the hinder ends of the glands beneath the bulbus are twisted round each other.

The *œsophagus* is thin, about 7 mm. long, entering in the middle of the larger facet of the posterior visceral mass, a little to the right. The cavity of the liver, as in the last species, performs the function of a stomach; it is small in extent. The *intestine* breaks through the middle of the liver, a little to the left; its loop lies anteriorly upon the anterior genital mass; posteriorly it runs in a deep groove on the right hand surface of the liver; in the middle of the anteriorly-directed portion of the intestine its width is greater (1·5 mm.), elsewhere it is only half as broad; its length when uncoiled was 1·5 cm. The digestive tract was empty.

The *liver* is 8 mm. long by 6 in breadth and 5·5 mm. in height; the anterior two-thirds of the right side hollowed out into a facet for the anterior genital mass; the hinder end is short and cylindrical; its proper brownish-grey colour is merely visible on the lower and right hand surface; elsewhere it is covered by the dirty yellow hermaphrodite gland. The small pear-shaped *gall-bladder* lies to the left, on the upper surface of the liver, close to the origin of the gut.

The faintly green *pericardium* and the *heart* were as usual. The green *blood gland* is 2 mm. in length, 1 mm. in breadth, and lies in front of and upon the anterior genital mass.—The whitish-yellow *renal syrinx* is small.

The *hermaphrodite gland* is thick, and yellowish in colour; it presents the usual structure; the lobules contain larger oogenous cells and spermatozoa.—The *anterior genital mass* is 5·5 mm. long by 3·5 mm. in height and 3 mm. in breadth; the efferent ducts are bluish-green, and project about 2·5 mm. The yellowish-white ampulla has a very slightly undulatory course; its length when straightened out is about 4 mm. The *spermatheca* (fig. 4, *a*) is spherical, 2·5 mm. in diameter, yellowish-white, it was full of semen; the vaginal efferent duct (fig. 4, *b*), together with the wider greenish-blue vagina (fig. 4, *c*), about one-half longer than the receptaculum; the uterine duct (fig. 4, *d*) is much longer and thinner. The pear-shaped *spermatocyst* (fig. 4, *e*) is very small, and sessile on the origin of the vaginal duct.[1] The *vas deferens* is long (about three times as long as the penis) and thin, whitish in colour, and passes into the conical greenish-blue coloured *penis*, which is about 4 mm. long by 2 mm. in width. At the base of the cavity of the præputium is a small perforated papilla, the glans. The *mucous gland* is white, the *albuminiparous gland* olive-brownish yellow; the duct greenish-blue outside as well as inside.

[1] The spermatocyst is quite as small in *Chromodoris semperi*. *Loc. cit.*, Taf. lv. figs. 6*b*, 7*b*.

Ceratosoma, Adams and Reeve.

Ceratosoma, A. Adams, Voyage of the "Samarang," Mollusca, 1848, p. 67.
„ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft x., 1876, pp. 391–410; Supplementheft i., 1880, pp. 28–31.

Corpus subcompressum, postice gradatim altius; nothaeum postice trilobatum; lobi laterales breviores et rotundati, posterior linguiformis; rhinophoria retractilia, clavo perfoliato; tentacula brevia; podarium sat angustum, cauda elongata.

Armatura labialis fortior, e hamulis minutissimis formata. Radula rhachide nuda, pleuris multidentatis; dentes hamati.—Penis inermis.

This genus was established by (Gray[1]) Adams and Reeve, in 1848; the definition given, however, was only superficial and entirely useless.[2] Alder and Hancock[3] corrected several of the mistakes made by these last-mentioned authors. The next contribution to the literature of the genus was a small memoir published by myself in 1876.

Ceratosoma is at once distinguishable by its peculiar form. The head is rather flat, with a short frontal margin prominent at the edges; the club of the retractile rhinophoria is provided with the usual leaves. The tentacles, as those of *Chromodoris*, can be quasi-invaginated. The body is higher behind than in front; on either side of the hindermost portion of the flattened dorsal surface is a rounded lobe, behind the back ends in a tongue-shaped process; in front of this is the circular opening for the retractile branchia. The foot is narrow and small, but the tail strong and long. The armature of the labial disk rather strong and composed of a number of closely-set minute hooks. The radula has a bare rhachis, numerous hook-shaped lateral teeth on either side. The penis is unarmed.

The genus is apparently confined to the tropics, and lives, according to Adams, crawling upon the surface of Madrepores.

Only a few species are properly known, but a number of new forms have been published by Fischer and by Abraham.[4]

[1] Alder and Hancock, Woodward, and other authors regard Gray as having the priority. The name *Ceratosoma* is to be found in vol. iv. of his Figures of Molluscous Animals (pp. 13, 42, 105: "back produced behind"), which appeared in 1850. The Malacological part of the Voyage of the "Samarang" bears on its title page the date 1848, and in this volume the genus *Ceratosoma* is described and marked "nov. gen."; according to the chief title, the Voyage of the "Samarang" did not appear until 1850. The question of priority, therefore, is difficult to settle. Perhaps Adams's drawing actually passed through the hands of Gray (*cf. Journ. des Museum Godeffroy*, Heft vi., 1874, p. 95, *Bornella*), or possibly the latter formed the genus on the species *Doris trilobata*, figured by him in 1842.

[2] The English authors mention the rhinophoria as not being retractile, and their description of dorsal processes is rather confused, *cf.* Woodward, Manual of the Mollusca, vol. ii., 1854, p. 192.

[3] Alder and Hancock, Monogr. Brit. Nudibr. Moll., pt. vii., 1855, App. xix.

[4] MM. Crosse and Fischer, like Mr. Abraham, have been recently studying the Nudibranchiata. The former authors have increased the genus by one new species, but they regard *Ceratosoma* as closely allied ("très voisin") to *Thecacera*, *Polycera*, *Aegirus*, &c. (!), and are unable to distinguish *Goniodoris* from *Chromodoris*, and *Doriopsis* from *Doris*.

The following is a list of the species :—

1. *Ceratosoma cornigerum* (Adams), Bergh.
   Indian Ocean, Philippine Sea.

2. *Cerátosoma gracillimum*, Semper.
   Philippine Sea.

3. *Ceratosoma trilobatum*, Gray.
   Red Sea.

4. *Ceratosoma polyomma*, Bergh.
   Pacific Ocean (Pelew Islands).

5. *Ceratosoma caledonicum*, Fischer.
   Pacific (New Caledonia).

6. *Ceratosoma brevicaudatum*, Abraham.
   Pacific.

7. *Ceratosoma oblongum*, Abraham.
   Pacific (West Australia).

8. *Ceratosoma tenue*, Abraham.
   Habitat ?

Ceratosoma cornigerum (Adams), Bergh, var. ? (Pl. II. figs. 14–17; Pl. III. figs. 14–20).

Ceratosoma cornigerum, A. Adams, Voyage of the "Samarang," Mollusca, 1848, p. 68, pl. xix. fig. 5.
„ Adams, Bergh, Malacolog. Untersuch, *loc. cit.*, Heft x., 1876, pp.393–403, Taf. xlviii. figs. 15–27, Taf. xlix. figs. 1–5.

Habitat.—Philippine Sea (Samboangan).

One specimen of this species was dredged at Samboangan, in company with *Platydoris eurychlamys* and *Discodoris morphæa*, on February 1, 1875, from a depth of 10 fathoms. The specimen was well preserved in alcohol, and measured 4·3 cm. in length by 1 in breadth and 1·5 cm. in height; the hinder dorsal process, moreover, measured 6 mm.; the breadth of the foot 5 mm., the length of the tail 16 mm., the height of the rhinophoria 3 mm., of the branchia 3·5 mm. The *colour* was greyish-red, white speckled and covered with numerous white dots, especially on the anterior portion of the back. The stem of the rhinophoria

was reddish, the club yellowish with white dashes on the margins of its leaves, and with a white terminal papilla. The branchia is reddish-yellow, with a few scattered spots upon the branchial lamellæ.

The *form* of the body is as usual. The frontal margin is somewhat strongly developed; the dorsal margin does not stand out much, its lateral lobes in front of the branchia are rounded and but feebly developed; the *dorsal process* is conspicuous and strong, and convex on the upper surface, its lateral margins somewhat bent beneath. The holes of the rhinophoria are rounded, with an inconspicuous margin; the stem of the rhinophoria is powerful, and about the same length as the strongly developed club, which latter is provided on either side with from thirty-five to forty thin leaves. The branchial cleft, when the branchia is retracted, is of a rounded triangular form, 2·25 mm. in diameter, its smooth margin inconspicuous. The hinder end of the branchia is slightly rolled up, the gill has twelve leaves, which are frequently divided at the end into two to four twigs, themselves again branched.[1] The *anal papilla* is directed obliquely forwards, and is situated in the branchial circle enclosed by its two extremities; it is short and cylindrical in form, about 1 mm. high, truncated above, greyish in colour, with whitish stripes and points; its margin is finely crenate; at its base in front and to the right is the fine *renal aperture*. The *tentacles* are short papillæ on either side of the mouth. The *foot* is rather weak.

The intestines are not visible from the outside. The peritoneum is colourless.

The *central nervous system* I have already[2] described. The common commissure is about one-third of the transverse diameter of the central nervous system, and is evidently formed of three fused strands, of which the pleural is actually separate for some distance on the right side. The *distal olfactory* ganglia are situated at the base of the rhinophorial club, and form two bulb-shaped swellings of the nerve, lying one above the other, from which, as usual, numerous branches are given off. The short oval buccal ganglia are united by a short commissure, about equal in length to one-fourth of the longest diameter of the ganglia. The small gastro-œsophageal ganglia are short-stalked.[3]

One of the nervi optici had a quantity of black pigment, the other not. The *otocysts* are visible, with a lens, as chalk-white points; they are sessile and sack-shaped, somewhat flattened (Pl. III. fig. 14), of about ·14 mm. greatest diameter; each contains about three or four hundred round and oval otoconia, yellowish in colour, and about ·015 mm. in diameter. The leaves of the rhinophoria are almost completely devoid of the hardened cells. In the *skin* of the back and of the sides of the body there were numerous small hardened cells, but no larger ones. In the outer neurilemma of the central nervous system, especially round the cerebral ganglia, were a number of spicules, more or less calcified and roundish or longish oval in shape, reaching ·08 mm. in diameter (Pl. III. fig. 15), lying isolated or in groups. In the interstitial connective tissue of other parts of

[1] Bergh, *loc. cit.*, Taf. xlviii. fig. 15. [2] *Loc. cit.*, p. 395. [3] *Loc. cit.*, Taf. xlix. fig. 6.

the body there were only a few hardened cells, with the exception of that surrounding the main ducts of the genital apparatus, where there were a number of cells similar to, but rather larger and darker than, those found in the neurilemma.

The *mouth tube* is strong, about 5 mm. in length; its inner surface and the three retractor muscles are as usual. The *bulbus pharyngeus* is 5·5 mm. long by 5·3 in breadth and 4·5 mm. in height; the radula-sheath, moreover, projects backwards about 2 mm.; the retractor muscles as usual. The strongly arched labial disk (Pl. II. fig. 14) is covered on its inner half by the rather thick yellow *labial plate*, clothing the anterior portion of the buccal cavity to a breadth of about 1 mm. with a circular prehensile ring. The labial plate is made up of hook-shaped rods thickly adpressed at the ends, which in front (Pl. III. fig. 16) reach a height of ·04 mm. The broad, strong *tongue* has the usual deep cleft, which is clothed up over the margins by the clear yellow, somewhat feebly coloured radula. In this last were twenty-eight series of teeth (counted always at the outer margin of the radula); further back there were forty-five developed and four undeveloped series; the total number was thus seventy-seven. The first three rows of the tongue were very incomplete, and in front of them were the impressions left by two or three other series that had fallen off. On the narrow rhachis (Pl. III. fig. 17, *a*, 20, *aa*) were long, narrow, very low folds. In the fifth row of the tongue there were on either side 172 or 173 teeth, at the root of the tongue 186, and the number appeared to increase on passing back in the sheath to 200. (In another smaller specimen formerly studied by me,[1] there were 80, and in larger specimens 97–104 series of teeth; the smaller individual had 170 teeth in each series, the larger individuals as many as 239.) The teeth were of a clear yellow colour; the height of the outermost generally ·05 mm., the height of the plates increasing to ·12 mm. The innermost (Pl. III. fig. 17, *bb*) is provided with a small denticle below on the inside of the hook, and in a few of these teeth a higher magnifying power (750 diam.) showed also traces (fig. 17, *bb*) of two smaller ones; on the outer side of the same innermost plate, a little higher up, was a similar denticle (fig. 20, *bb*). In all the following ones, as far as the outermost (inclusive), this outer denticle was present (Pl. III. fig. 19), and only appeared to be absent here and there in single plates. Elsewhere the teeth showed the ordinary form; the three or four outermost ones were as usual smaller and more upright, with the denticle near the point of the thick hook (Pl. II. fig. 15, *aa*).[2]

The *salivary glands* band-like, whitish in colour, extended to the length of 15 mm.; the breadth was mostly ·8 mm., but they were narrower behind; they extend,[3] as already described, as far as the cardia. The duct was rather short, about 1 mm. in length.

The *œsophagus* is mostly about 1 cm. wide, wider still behind; it opens into the stomach, and receives behind the wide bile duct. The *stomach* is 9 mm. long by 4·5 mm. in

[1] *Loc. cit.*, p. 397

[2] The series of teeth of the specimen examined here were, as in *Ceratosoma gracillimum* (*loc. cit.*, p. 404), *nearly all* denticulated, which was *not* the case in the specimens formerly dissected by me.

[3] *Loc. cit.*, 1876, p. 399.

breadth, and is situated upon the anterior genital mass. The *gut* arises from the anterior part of the stomach, and immediately bends backwards, lying in a superficial furrow at the right margin of the liver; its length is about 2·5 cm., its diameter 2·5 mm. in front, about 1 mm. behind; in the interior were fine longitudinal folds, which could be followed as far as the anal papilla. The digestive tract contained, here and there, white soft masses of food, which consisted of indistinguishable animal remains and numerous broken teeth from the radula of the animal itself; the cavity of the liver contained a similar mass.

The *liver* is some 14 mm. long by 10 mm. in height and 7 mm. in breadth; the posterior end rounded; the anterior end oblique, inclined downwards and forwards, with a deep median furrow for the œsophagus; its colour was yellowish; the cavity wide, with large crypts. There seemed to be a pear-shaped gall-bladder, about 2·5 mm. long.

The *pericardium* is large, 8 mm. broad by 5 mm. in length; the yellowish-coloured ventricle of the heart is 1·5 mm. long. The anterior *blood gland* of roundish angular contour, of a greatest diameter of 1·2 mm.; the posterior one longish oval, 3·5 mm. long; both were very much flattened and whitish in colour. The *kidney* is made up of short club-shaped acini, in which were numerous concrementa. The *renal syrinx* is yellowish and bulb-shaped, of about ·8 mm. in diameter, of the usual structure.

The *hermaphrodite gland* is made up of numerous, mostly roundish, whitish-yellow lobules, and covers the liver everywhere as far as the origin of the bile duct; the ovarian follicles are few in number, round and pear-shaped, and surround the testicular part; the gonoblasts well developed. The thin white hermaphrodite duct takes its origin at the right side of the cardia.—The *anterior genital mass* is three-sided, the anterior surface being somewhat excavated to receive the *bulbus pharyngeus;* its height is 8·5 mm., length 6·5 mm., breadth 5·5 mm.; the main efferent ducts project 1·2 mm. The opaque yellow *ampulla* is strongly bent, and placed in a deep cleft on the hinder margin of the genital mass; when extended it measured 1 cm. long by ·4–·8 mm. broad. The very long *prostatic portion of the vas deferens* forms a whitish coil upon the upper surface of the ampulla; its diameter is about ·5 mm.; it passes into the much thinner yellowish *muscular part* (Pl. II. fig. 16, *a*), which too lies rolled into a flattened coil at the anterior margin of the genital mass; when unrolled the length of this last part is 3·3 cm.; its last part passes downwards from the anterior margin of the genital mass into a prolongation (penis) bent in the middle and directed first downwards then upwards (fig. 16, *b*), and about 8 mm. in length; this prolongation was about two or three times as thick as the vas deferens, and through it the seminal passage wound its way to the very short præputium (fig. 16, *c*). The *spermatheca* (fig. 17, *a*) is yellowish in colour, and lies behind the ampulla, quite enclosed by the mucous gland; it is spherical in shape, and has a diameter of 3·5 mm.; it was filled with semen and detritus; the vaginal (fig. 17, *b*) and uterine (fig. 17, *d*) ducts pass near each other out of the spermatheca. On the root

of the latter is situated the sessile *spermatocyst;* this organ is yellow in colour and sausage-shaped, bent in the middle; when extended it measured 7 mm. long; it was full of semen. The vaginal duct is short, about one-third of the length of the spermatheca, widening below to form the vagina (fig. 17, *c*); both portions are lined with a strong cuticle. The *mucous gland* is whitish; the more yellowish albuminiparous gland is situated on its anterior and inner side. The whitish tongue-shaped *vestibulo-vaginal* gland measures 1·5 mm. long, and is sessile.

Whether the form investigated here is merely a varietyof *Ceratosoma cornigerum*, or is a distinct species, must be left for the present undecided. The armature of the tongue, and perhaps the structure of the genital apparatus, might support the latter view.

Archidoris, Bergh.

Archidoris, Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft xiv., 1878, p. 616; Supplementheft i., 1880, pp. 33–35.
„ Bergh, On the Nudibr. Gastr. Moll. of the North Pacific Ocean (*in* Dall, Scientific Results of the Exploration of Alaska, vol. i., art v.), part 1, 1879, pp. 106–108 (162–164).

Corpus non durum, subdepressum; dorso granuloso vel tuberculoso. Tentacula brevia, crassa, sulco marginali externo. Branchia (retractilis) e foliistri- vel quadripinnatis sat paucis formata. Podarium sat latum, margine anteriore superficialiter sulcatum.

Armatura labialis nulla. Radula rhachide nuda, pleuris multidentatis; dentes hamati.—Penis inermis; vagina inermis.

When Linnæus founded the genus *Doris*, in the tenth edition of his Systema Naturæ (1758), he only referred a single species to it,—his *Doris verrucosa*.[1] This species, founded solely on the figures of Seba and Rumphius, is probably indeterminable, and the *Doris* of the tenth edition of the Systema Naturæ should, therefore, not have been retained in subsequent editions. In the twelfth edition (1767) the genus includes three other forms,—*Doris bilamellata*, *Doris lævis*, and *Doris argo*, besides *Doris verrucosa*, which still figures as the first species. One of these three should become the type of the restricted genus, but which? It is much better to do away altogether with the name *Doris* as a generic designation (especially as Linnæus also used it in another sense for the animal of various shell-bearing molluscs), and with this view I have formed the genus *Archidoris*.

This generic group, which is congeneric with the first of the sections established by Alder and Hancock in their systematic prospectus,[2] is rather distinctly marked. The

[1] Bergh, Malacolog. Untersuch., *loc. cit.*, Heft x., 1876, p. 388.
[2] Monogr. of Brit. Nudibr. Moll., part vii., p. xvi., 1855.

consistency of the animal is not hard, the *form* is plump and slightly depressed; the *back* more or less granular or tuberculate, the *openings for the rhinophores* simple; the *tentacles* short, thick folds at the sides of the small head, with an external furrow; the retractile gill composed of a few tripinnate or quadripinnate leaves; the foot broad, with a furrow on the anterior margin. The *labial disk* merely clothed by a simple, thick cuticle. The *radula* with naked rhachis; the pleuræ with numerous hook-shaped plates. The large ventricle free. *Penis* and *vagina* both unarmed.

The *Archidorides* approach the *Staurodorides* in their general form and external features, but still more closely in their internal structure, though the latter are still distinguished by their numerous and simply pinnate branchial leaves, and by the development of protecting tubercles on the margin of the rhinophore-holes and of the branchial cavity.[1] The *Homoiodorides* perhaps stand in still closer proximity to the *Archidorides*, though they differ specially from the latter in a peculiar armature of the vagina.[2]

Only a few species of the group are as yet known:—

1. *Archidoris tuberculata* (Cuvier).
   North Atlantic, Mediterranean.

2. *Archidoris flammea* (Alder and Hancock).
   North Atlantic.

3. *Archidoris montereyensis* (Cooper).
   North Pacific.

4. *Archidoris kerguelenensis*, n. sp.
   North Pacific.

5. *Archidoris australis*, n. sp.
   North Pacific.

1. *Archidoris kerguelenensis*, n. sp. (Pl. I. figs. 1–12).

   ? *Doris tuberculata*, Cuv. ? Th. Studer, Die Fauna von Kerguelensland, Archiv f. Naturg., Jahrg. xlv., Bd. i. p. 128, 1879.

Habitat.—Kerguelen Islands, Pacific Ocean.

The form mentioned by Studer is probably the same as that now described. There was only one individual of this species, taken January 17, 1874, off Royal Sound, Kerguelen, lat. 49° 40′ S., long. 70° 20′ E., depth 25 fathoms.

[1] Bergh, Malacolog. Untersuch., *loc. cit.*, Heft xiv., 1878, p. 578; Supplementheft i., 1880, pp. 36–40.

[2] R. Bergh, Beitr. zur Kenntn. d. japan. Nudibr. II., Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxxi., 1881, pp. 222–227.

This specimen, which was very well preserved and only slightly hardened, was nearly 4·5 cm. long by 1·8 cm. broad and 1·2 cm. high. The breadth of the mantle-border came to 4·5 mm., of the foot to about 12 mm.; the length of the tail was 5 mm., the diameter of the transversely oval branchial opening nearly 8 mm.; the height of the retracted rhinophores was 4 mm., of the retracted gill nearly 5 mm.; the length of the tentacles 3 mm.; the largest dorsal papillæ were 1·3 mm. in diameter, and almost the same in height. The *colour* of the animal was yellowish throughout; in front and on the lateral portions of the back ochre-yellow, so too on the upper sides of the pedal border, but rather paler; the rhinophores and gill were yellowish-white.

The *form* of the body was an elongated oval, the border of the mantle not broad, rather powerful. The *back*, which is slightly convex, is entirely covered with (Pl. I. fig. 2) papillæ of various sizes[1] lying closely together, the smallest chiefly on the margin of the mantle. The *rhinophore-openings*, which lie pretty near the front, are roundish; the margin, which hardly projects at all, is furnished with small papillæ. The rhinophores are powerful; the club with about thirty to forty broad leaves, and with small terminal papilla. The transversely oval, wide *branchial opening* has a somewhat projecting, slightly scalloped margin, also furnished with small papillæ. The gill is formed of seven tripinnate leaves, arranged in the shape of a large horse-shoe. The *anal papilla* (2·5 mm. high), with its slightly scalloped margin, lies behind in the opening of the horse-shoe, which it completely fills; the fissure-shaped *renal pore* lies to the right at the base of the anal nipple. The *outer mouth* was contracted like a pore; on either side of it the fold-like *tentacle*, furnished with a longitudinal furrow. The *sides of the body* had almost disappeared; the contracted *genital opening* in the usual place. The *foot* is strong, only projecting slightly (about 2·5 mm.) from the sides of the body, and rather more in front (4·5 mm.); the anterior end rounded, with marginal furrow; the posterior end slightly pointed, somewhat rounded.

The intestines do not shine through any part of the body. The peritoneum is colourless.

The *central nervous system* is greatly flattened (fig. 1); the cerebro-pleural ganglia kidney-shaped, rather thicker before than behind, the two portions indistinctly separated; the pedal ganglia (fig. 1, *a*, *a*) a little larger than the pleural. The common commissure (fig. 1, *b*) rather wide and powerful. Each proximal olfactory ganglion (fig. 1) forms a small, roundish, short-stalked swelling at the origin of the nervus olfactorius, the distal ganglia olfactoria a small oval swelling at the root of the rhinophores. The buccal ganglia (fig. 1, *c*) are rather larger than the ganglia olfactoria proximalia, longish-oval in shape, and connected by a short commissure; the gastro-œsophageal ganglia are rather short-stalked, also longish-oval in shape, and have a single row of larger nerve-cells (fig. 1).

[1] R. Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp., Th. II. Bd. ii.), Heft xiii., 1878, Taf. lxiv. fig. 20 (*Archidoris tuberculata*).

The *eyes* (fig. 1) have coal-black pigment, with a chitinous-yellow lens; the optic nerves about half as long again as the eyes, one of them was pigmented black throughout its whole length, and there is a small ganglion opticum at the base of each nerve. The *otocysts* are spherical, rather larger than the eyes, and closely filled with from 200 to 300 of the usual otoconia. The leaves of the *rhinophores* are stiffened by (fig. 3) greatly hardened long spicules, which amount to ·035 mm. in diameter; there are a very great number of large spicules in the axis of the club, and in the stalk almost displacing the other tissue. The *dorsal papillæ* are rendered extremely stiff (fig. 2) by the spicules penetrating them, which are also present everywhere in the skin. These spicules, as well as those already mentioned, are usually very much hardened, very long, usually pointed at both ends, the surface being almost or perfectly even. There were commonly only a few hardened cells spread in the interstitial connective tissue, but there were besides some spicules spread around the efferent ducts of the anterior genital mass.

The very strong *buccal tube* was 6 mm. long; the three pairs of retractors the same as usual; the inside with the usual posterior circular and longitudinal folds. The very strong *bulbus pharyngeus* 8 mm. long, 6·5 mm. high, and 6 mm. broad; the sheath of the radula projecting downwards 3·8 mm. at the posterior end; the retractors and the structure of the bulbus on the whole much as usual. The labial disk covered with a strong soft cuticle; the buccal opening as usual. The *tongue* broad and powerful, the deep broad cleft and the margins of its contiguous parts covered by the pale chitinous-yellow radula. In the latter there were twelve rows of dental plates, of which the first four were more or less incomplete; eleven developed rows and four still imperfect rows lie, moreover, under the strong roof of the radula and in its thick sheath; the total number of the rows amounted to twenty-seven. There were thirty-eight dental plates (on each side) in the first complete, the fifth, row of the tongue, and the number seemed only to increase at most to two or three more towards the back. The colour of the plates was a pale chitinous-yellow. The length of the innermost plate on the hindermost part of the tongue came to ·2 mm., and the height of the hook to ·12 mm. The length of the plates amounted to about ·53 mm., and the height of the hook to about ·32 mm. The length of the outermost plate amounted to ·14 mm., the height to ·08 mm.; the length of the next plate to ·18 mm. with a height of ·14 mm.; the length and height of the following plate respectively ·25 mm. and ·25 mm. The plates were of the usual form, with the usual wing-shaped development of the body (figs. 4–9); the inner as usual being smaller, with proportionately thicker hook (figs. 4–7), the outer (fig. 9) with more slender hook and shorter body.

The *salivary glands* are yellowish-white, flattened, bent together in the middle, when extended about 1·5 cm. long, the right gland not reaching so far back as the left; the anterior half thinner, amounting hardly to one-third the diameter of the posterior half; the anterior part narrow, and gradually passing into the excretory duct; the posterior half about 3 mm. in breadth by ·75–1·2 mm. in thickness. The *œsophagus* is nearly

13·5 mm. in length, the diameter before and behind is nearly 1·5–·2 mm., whilst in the middle it increases to 5 mm.; numerous strong longitudinal folds on the inside. The *œsophagus* passes into the posterior part of the stomach lying to the right (fig. 10, *a*); the roundish opening of the biliary duct lies beside the cardia. The sac-shaped stomach is 8 mm. long and 5 mm. in diameter; the inside has strong longitudinal folds. The *intestine* (fig. 10, *b*) arises from the anterior end of the stomach, forms, as usual, an angle resting on the upper side of the *œsophagus* and of the anterior genital mass, and then runs almost in a straight line to the anal papilla. The entire length of the intestine came to nearly 2·8 cm., the diameter to from 2·5–1·75 mm.; the inside with a number of longitudinal folds which passed above into the folds of the stomach. The scanty *contents* of the digestive cavity were a soft mass of indeterminable animal remains.

The *posterior visceral mass* (liver) is nearly 1·8 cm. long, and 1 cm. broad, and ·9 cm. high in the middle. The upper side slopes obliquely before and behind, with a broad furrow, which is occupied by the renal chamber, on the right margin is a superficial furrow for the intestine. The anterior half of the under and of the right side is very much flattened (by the anterior genital mass); the anterior end having a broad submedial cleft for the stomach, the posterior end rounded. The lower side, which the hermaphrodite gland does not clothe, was greyish, and the substance, for the most part, greyish-yellow. The cavity is rather narrow, with the usual openings. The *gall-bladder* lies to the right below the stomach, and falls obliquely downwards; it is nearly 4 mm. long, pyriform, yellowish in colour, apparently opening into the biliary duct; the inside is set with thick papillæ in rows, the neck smooth.

The *pericardium* is elongated, 12 mm. long by 8 mm. broad. The yellowish *ventricle of the heart* 4 mm. long. The *blood glands* (fig. 1, *dd*) pass one into the other on the upper side of the central nervous system. They are altogether 7 mm. long, yellowish-white; the upper side is more convex and smooth, the lower side less smooth and flatter; the margins lobed; the posterior is swollen out into a small process towards the front on the lower side of the pleural ganglia.

The *urinary chamber* is wide, measuring as much as 6·5 mm. in breadth behind, and becoming narrower in front; the anterior end extending as a smooth, thin-walled cæcal sac, nearly 7 mm. long to 2·25 mm. broad, between the stomach and the intestine (fig. 10, *c*). The walls of the renal chamber show the usual openings, which are wider towards the back of the chamber and against the median line. The whitish-yellow *renal syrinx*, which is almost cylindrical, nearly 5 mm. long and 2 mm. in diameter, appears to open immediately into the renal chamber; the folds on the inside are rather thick and less numerous. The renal substance the same as usual.

The *hermaphrodite gland* is a thin, loosely connected whitish-yellow layer, covering the upper side of the posterior visceral mass as far as around its rounded margins, and also the upper part of the anterior end; there are large oogene cells and zoosperms in the lobes.

The thin, whitish duct of the hermaphrodite gland issues on the upper side of the cardia, and runs obliquely downwards to the *anterior genital mass*. The latter is large, 14·5 mm. long by 7·5 mm. broad, and 9 mm. high, yellowish-white, thicker before, tapering behind, the right side arched, the left side convex before and slightly hollowed out behind; the principal efferent ducts projecting 3 mm. The *ampulla* of the hermaphrodite duct is yellow, lying on the middle of the left side; it forms a few curves, and when extended is nearly 1 cm. long, and measures almost 1 mm. in diameter. The male branch of the ampulla is attached for a length of nearly 1·5 mm., and then passes into the *spermatic duct*, which forms several long loops, measuring when extended nearly 3·3 cm. by ·5 mm., in diameter, and winding on the front and on the inner side of the genital mass. Below the spermatic duct (fig. 12, *a*) becomes somewhat dilated, and forms the *penis* (præputium) (fig. 12, *b*), nearly 2 mm. long, the upper half of which is filled with the conical unarmed glans. Upon the anterior end of the genital mass lies the spherical, yellowish *spermatheca* (fig. 11, *a*), nearly 3·5 mm. in diameter, filled with sperma and detritus. The *vaginal duct* (fig. 11, *b*) is rather strong, running almost straight, nearly 7 mm. long by nearly ·75 mm. in diameter; the inner side with strong, mostly pinnate folds. The *uterine duct* rises nearer the vaginal (fig. 11, *de*), but is rather longer, about as thick as the last, but narrowed below, and opening near the root of the duct of the mucous gland. The spermatocyst is attached to the base of the uterine duct (fig. 11, *c*); it is also yellowish-white, sac-shaped, somewhat bent, measuring when extended 4·3 mm. in length, and swollen with spermatozoa. The *mucous gland* is very large, forming by far the largest part of the genital mass; its cavity was wide but empty; the *albuminiparous gland*, which projected in front on the left side, was yellower; the duct of the *mucous gland* had the usual fold. A vulvo-vaginal gland was not found.

2. *Archidoris australis*, n. sp. (Pl. I. figs. 13–18; Pl. II. fig. 13).

Habitat.—Indo-Australian Ocean, Kerguelen Islands.

There was only a single individual of this species, taken off Howe's Foreland, Kerguelen Island, January 27, 1874, at a depth of 95 fathoms.

This specimen, which was well-preserved in spirit, was 15·5 mm. long by 8·5 mm. broad and 6 mm. high; the breadth of the mantle-border came to 3 mm., the breadth of the foot to 4·5 mm., the length of the tail to 2·6 mm., the height of the (retracted) rhinophores to 2 mm., of the extended gill nearly to 2 mm. The *colour* of the back was yellowish with touches of faint green; that of the lower side of the mantle-border whitish, of the foot yellowish-white; the rhinophores and the gill of the same colour as the back.

The *form* is oval, the consistence as above. The *back* is entirely and pretty thickly

covered with nodules (Pl. I. fig. 15) of various sizes, up to ·5 mm. in diameter; the largest, fewer in number, short, cylindrical or rather hemispherical, and occasionally slightly constricted at the base. Similar nodules, partly large, partly smaller, are found on the margin of the simple round rhinophore-openings; likewise on the simple margin of the branchial slit, where they sometimes alternate in size (fig. 14). The club of the *rhinophoria* is strong, with nearly twenty-five broad, thin leaves. The *branchia* is composed of from eleven to twelve slender leaves, simple below, bipinnate and tripinnate above. The *anal papilla* is low, obliquely truncated; beside it, to the right, is the *renal pore*. The (external) *oral orifice* is strongly contracted; the *tentacles* short, fold-shaped. The *foot* strong; the anterior margin with deep furrow and rounded corners, the tail somewhat pointed.

The intestines are not visible through the body-wall at any point; the peritoneum is colourless.

The *central nervous system* (Pl. I. fig. 13) is not much flattened. The cerebro-pleural ganglia (fig. 13, *ab*) kidney-shaped, the two divisions almost equal in size; the pedal ganglia (fig. 13, *c,c*) roundish in outline; the large common commissure (fig. 13, *d*) distinctly showing at the roots that it is composed of three separate commissures. The proximal olfactory ganglia (fig. 13, *e,e*) are developed on one side of the nerve; the distal ones (fig. 13, *f*) rather smaller and roundish. The optic ganglia (fig. 13) are roundish, sessile, rather smaller than the olfactory ones (fig. 13). The buccal ganglia at least four times as large as the proximal olfactory, roundish in outline, and connected by a very short commissure (fig. 13, *g*). The rather short-stalked gastro-œsophageal ganglia (fig. 13, *h,h*) are developed on one side of the nerve; a little larger than the lower olfactory ganglia; the nervus œsophagealis major is bifurcated, showing on the branches small ganglia. A short-stalked ganglion genitale (fig. 13, *i*) is connected with the right pleural ganglion.

The short-stalked *eye* (fig. 13) has black pigment and an obscure chitinous yellow lens. The *otocysts*, visible under the magnifying glass as chalk-white points, are rather smaller than the eyes, spherical, filled with about sixty of the usual otoconia, of up to ·02 mm. in diameter. The thin leaves of the *rhinophoria* are without spicules. The tough *skin* and the dorsal tubercles (fig. 15) generally have only a few larger, crumpled, hardened spicules, and smaller groups of hardened cells. Only a few hardened cells in the *interstitial connective tissue*.

The *mouth tube* was large, nearly 3 mm. long, and the same in diameter; the three pairs of retractors and the inside as usual. The *bulbus pharyngeus* rather larger than the mouth tube, 3·5 mm. long by 2·75 mm. high and 2·5 mm. broad; the thick sheath of the radula still projecting 1·5 mm. behind; the retractors as usual; the labial disk covered with a strong, faintly yellow cuticle, with a narrow (slightly radiate) oral fissure. The glittering chitinous-yellow radula of the strong *tongue* with ten rows of teeth plates, and with traces of two former rows at the point; there were also in the radula-sheath thirteen

developed and four undeveloped rows, so that their total number amounted to twenty-seven. The first five (outer) rows were incomplete; in the first complete row, the sixth, there were thirty-three plates (on either side), and the number hardly increased towards the back. The *plates* were very pale yellow; the height of the five outermost plates (fig. 18) was ·08–·1–·12–·14–·18 mm.; the height then gradually increased, sometimes reaching ·25 mm., and again diminishing from the middle of the row inwards, and decreasing to about ·12 mm. (fig. 16). The form was as usual, the two outermost much more slender (fig. 18, *a*,*a*).

The *salivary glands* yellowish, elongate, bent at the middle and again ascending on the posterior end of the bulbus pharyngeus.

The *œsophagus* nearly 3·5 mm. long, with strong longitudinal folds on the inside. The *stomach*, which projects out of the fissure of the liver, is large, nearly 3·5 mm. long by 2·75 mm. broad and 1·4 mm. high. The *intestine* opens from its anterior end, and runs almost straight backwards; it is nearly 12 mm. long, and ·75 mm. broad almost throughout; the inside shows the usual longitudinal folds. The whitish, soft contents of the digestive cavity were a mass of indeterminable animal remains.

The *liver* is nearly 7 mm. long, by 5 mm. broad and 4·75 mm. high, shaped like a short cone; the hollowed anterior end with a small facet below (for the anterior genital mass); the outside colour grey, the substance yellowish. The hepatic cavity is tolerably wide with the usual crypts. The *gall-bladder* lies to the right below the stomach, a yellowish-white, elongate pyriform sac, nearly 1·75 mm. long, and measuring ·75 mm. in diameter at the bottom.

The *pericardium* and the heart as usual. The *blood glands* joined by a short neck on the upper side of the central nervous system, greyish-yellowish; flattened, especially the anterior gland; they were almost of equal size and quadrangular with rounded angles in outline, their largest diameter nearly 1·5 mm.—The yellowish *renal syrinx* melon-shaped; the urinary chamber narrow; the kidney, with a beautiful dendritic ramification, covering the whole upper side of the posterior visceral mass (Pl. II. fig. 13).

The grey *hermaphrodite gland* contrasts with the yellowish liver, which it covers as a thin layer; the small lobes without developed reproductive elements. The yellowish-white *anterior genital mass* was undeveloped, nearly 1·2 mm. long, and as much as 0·8 mm. broad and high. The *ampulla* of the duct of the hermaphrodite gland was somewhat short and thin. The spermatheca spherical; the spermatocyst sac-shaped, longer than the spermatheca.

This species appears to be distinct from the preceding, as is shown even by the form and the nature of the gill. They are both specifically distinct from *Archidoris montereyensis*.[1]

[1] Bergh, On the Nudibr. Gastr. Moll., &c., I., *loc. cit.*, pp. 107 (163), pl. xvi. figs. 10, 11.

Discodoris, Bergh.

Discodoris, Bergh, Jahrb. deutsch. d. malacozool. Gesellsch., Bd. iv. 1877, p. 61.
„ Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft xii., 1877, pp. 518–539; Supplementheft i. 1880, pp. 47–50; ii. 1881, pp. 108–112.

Corpus subdepressum, circumferentia rotundata vel ovali, ut plurimum molle, supra minute granulatum. Apertura branchialis leviter crenulata, stellata vel bilabiata. Margo anterior podarii bilabiatus, labium superius plus minusve fissum.

Laminæ labiales e baculis minutis formatæ. Lingua rhachide nuda, pleuris multidentatis dentibus hamatis.—Prostata magna; penis inermis.

This generic form is characterised by the *flattened shape* of the body, oval or roundish in circumference, and mostly of rather *soft consistence*, the dorsal side finely granulated. The branchial aperture crenulate, stellate, or bilabiate. The *tentacles* finger-shaped. The anterior margin of the foot with two lips, the upper one cleft in the middle. The *labial plates*, nearly surrounding the mouth proper, are composed of minute rods. The rhachis of the radula without plates; the pleuræ with many hook-shaped teeth. Prostate large; penis unarmed.

The *Discodorides* differ considerably from the *Platydorides* and the *Asteronoti*, and on the other hand approach the *Thordisæ*, which still present the villous dorsum, and lack the armature of the labial disk.[1]

Very little is known of the biological relations of this group. Alder and Hancock saw the spawn of *Discodoris concinna*. Elliot observed the animal shedding pieces of the brim of the mantle (in *Discodoris fragilis*).

The genus is particularly represented in tropical and subtropical seas; only a small number of species has hitherto been examined or described.

1. *Discodoris boholiensis*, Bergh.
Philippine Sea.

2. *Discodoris meta*, Bergh.
Philippine Sea.

3. *Discodoris cebuensis*, Bergh.
Philippine Sea.

4. *Discodoris notha*, Bergh.
Philippine Sea.

5. *Discodoris morphœa*, Bergh.
Philippine Sea.

[1] *Cf.* my Malacolog. Untersuch., *loc. cit.*, Heft xii., 1877, pp. 540–542.

6. *Discodoris muta*, Bergh.
Antilles Sea.

7. *Discodoris modesta*, Bergh.
Philippine Sea.

8. *Discodoris schmeltziana* (Garrett), Bergh.
Pacific Ocean.

9. *Discodoris indecora*, Bergh.
Mediterranean.

10. *Discodoris pardalis* (Alder and Hancock).
Indian Ocean.

11. *Discodoris concinna* (Alder and Hancock).
Indian Ocean.

12. *Discodoris fragilis* (Alder and Hancock).
Indian Ocean.

13. *Discodoris vestita?* (Abraham).
Pacific Ocean, Straits of Magellan.

14. *Discodoris raripilosa?* (Abraham).
Habitat ?

15. *Discodoris stragulata?* (Abraham).
Habitat ?

Discodoris morphæa, Bergh (Pl. I. figs. 19–22; Pl. II. figs. 1–12; Pl. III. fig. 13).

Discodoris morphæa, Bergh, Malacolog. Untersuch., *loc. cit.*, Heft xii., 1877, pp. 536–539, Taf. lx. figs. 18–22; Taf. lxi. figs. 1–5.

Habitat.—Philippine Sea (Samboangan).

A single individual of this species was dredged (along with a specimen of *Ceratosoma cornigerum* and one of *Platydoris eurychlamys*), February 1, 1875, on the reefs near Samboangan, at a depth of 10 fathoms.

The individual, which was very well preserved in alcohol, was 6·2 cm. long by 6 cm. broad and 1·8 cm. high; the breadth of the border of the mantle 2·3 cm., of the foot 1·8 cm.; the height of the rhinophores 4·5 mm.; the breadth of the (contracted) branchial fissure 4 mm., the height of the gill 8 mm.—The *colour* of the dorsal side was

pale greyish-yellow, with scattered large (nearly 12 mm. in diameter), roundish, annular or irregular, brown-grey and black patches; the largest of these were on the back proper; the annular chiefly on the border of the mantle. The fundamental colour of the lower side of the mantle-border paler than that of the upper side. This fundamental colour was, however, replaced in the inner two-thirds by large brownish-black, mostly confluent patches, which therefore formed a broad band, interrupted here and there; and this, again, then formed irregular broad tongues, running here and there outwards and inwards above the sides of the body; small scattered patches, mostly a little paler in colour, were visible on the outer third of the lower side. The sides of the body are yellowish and blackish; the pedal sole principally black and blackish-brown, the sides and the margins yellowish; the upper side of the foot and of the tail like the sides of the body. The head of the same colour, but paler; the tentacles yellowish. The stalks of the rhinophores black-brown, with whitish terminal papilla. The gill dirty yellow and blackish-brown speckled; as also the anal papilla.

The shape of the animal as usual—roundish and depressed. The *back* itself was arched, with a broad, soft mantle-border, which was much broader (20 mm.) behind than before (10 mm.). The whole upper side of the animal was thickly covered up to and upon the margins of the rhinophore-openings and of the branchial fissure, with small (diameter ·5 mm. or less), slightly projecting, sessile, rounded nodules (Pl. II. fig. 1). The marginal portion of the mantle-border soft, strongly bent up and down, somewhat indented here and there; the lower side smooth, showing whitish reticulate marks shining through it under the magnifying glass. The (contracted) *rhinophore-openings* are situated at the points of knobs, which project about 1·5 mm., and are scalloped; the *rhinophores* themselves have a strong stalk, amounting to nearly a third of the whole height, the strong club has about forty broad leaves (on either side). The *branchial* fissure lies on the top of a knob, similar to that of the rhinophores, and is also scalloped, the scallops being again serrated. The gill is composed of six very strong tripinnate pinnæ. The (3 mm.) high cylindrical *anal papilla* is slender, truncated above, with a scalloped margin; the *renal pore* lies in front to the right, at the base of the anus. The *head* is small, with smaller finger-shaped *tentacles;* the outer mouth strongly contracted. The *sides of the body* are quite low; the strongly-contracted genital papilla in the usual place. The *foot* is strong and broad, the corners of the anterior end rounded, the posterior end somewhat narrowed and rounded; the anterior end has a tolerably deep furrow, the rather broad upper lip is fissured in the mesial line; the tail is about 4·5 mm. long.

The viscera are not visible through the body-wall at any point. The (pseudo-) peritoneum is colourless.

The *central nervous system* was rather flattened; it was with some difficulty separated by dissection from its loose but adherent capsule, and even then it was not easy to distinguish the ganglia, owing in part to their coarsely nodular structure. The

cerebro-pleural ganglia are short, rather longer than broad; the cerebral and the pleural ganglia are of nearly equal size; the pedal ganglia, lying at the outside of the middle of the former, nearly as large as the pleural and roundish in outline. The large common commissure is nearly half as long again as the mean diameter of the central nervous system; all the three commissures are contained in a common sheath. The proximal olfactory ganglia are rather small, nearly sessile; the distal ones at the base of the club being only a little smaller than the proximal, and roundish. The buccal ganglia are shortly-pyriform, plano-convex, the broad ends passing almost immediately one into the other; the gastro-œsophageal ganglia are short-stalked, nearly one-eighth the size of the preceding.

The *eyes* are very short-stalked, the greatest diameter ·3 mm., slightly flattened on the lower side, with pitch-black pigment and rather large pale-yellowish lens. The *otocysts* are visible as chalk-white points on the lower side of the central nervous system; they are almost spherical (Pl. I. fig. 19), nearly ·12 in diameter, and closely packed with some hundreds of the usual otoconia, the largest of which were ·009 mm. in diameter. The thin leaves of the *rhinophores*, furnished only here and there with isolated knots, were stiffened with long (up to about ·8 mm.), fusiform, strongly hardened spicules of about ·025 mm. in diameter. The spicules were still more numerous in the stalk and generally in the axis of the rhinophoria, where they had almost completely replaced the other tissue. The *tentacles* had a very large number of spicules lying in different directions, but diminishing in number towards the point. There were only a small number at the head. The very low nodules of the *back* were richly furnished with (figs. 20, 21) the usual kind of spicules, the points of which often projected (Pl. II. fig. 1) on the surface. A quantity of similar spicules, most of them very long, were present on the lower side of the mantle-border; they were placed very irregularly, and often formed large heaps and node-like points. The relation of the spicules was exactly the same in the sides of the body and in the pedal sole. There were only a few larger hardened cells and spicules present in the *interstitial connective tissue*, even in the periphery of the principal efferent ducts of the reproductive apparatus.

The *mouth tube* was large, nearly 6·5 mm. long, and 7 mm. broad behind, somewhat flattened; the inside, for rather more than the posterior third, was of a bluish-black colour. The three pairs of *retractors* were very strong, with an additional weaker more mesially situated pair above; the inside showed the usual upper circular fold and also the upper three-fourths of the longitudinal folds of the bluish-black colour shining through externally; longish spots of the same colour appeared thickly scattered below.—The *bulbus pharyngeus* was strong, nearly 6·5 mm. long by 7 mm. broad and 5·5 mm. high; the sheath of the radula still projecting backwards about 2·2 mm.; the long retractors very strong. The labial disk was large, and covered with a white cuticle; round about, and near the perpendicular buccal fissure, this last passes into a chitinous yellow *prehensile ring*, which only enters the mouth a little way, and has a mean diameter of ·8 mm. This

ring (Pl. II. fig. 2) was rather broader above (fig. 2, *a*), but otherwise of uniform breadth, interrupted in the mesial line both above and below; above by a narrow furrow, below by a broad interspace (fig. 2, *b*). The prehensile ring is formed of perpendicular, tolerably thin, small (figs. 3, 4) rods, which attain a height of ·18 mm. The *tongue* was large and broad, with a deep cleft, which was covered beyond the edge with the pale chitinous yellow, varying-coloured radula. In the latter there were eighteen rows of dental plates, and in the short, thick radula-sheath sixteen more developed rows and three imperfectly developed, so that their total number amounted to thirty-seven. There were the marks of two other rows, which had been lost, at the point of the tongue; the first six or seven were incomplete, and the plates often injured. There were seventy plates (on either side) in the eighth row of the tongue, and seventy-three at the upper root of the tongue, and the number seemed hardly to increase backwards. The *plates* were of a pale yellowish colour; the height of the outermost four amounted to ·075–·1–·14–·16 mm.; the height increased to nearly ·28 mm., and then gradually diminished, till in the three innermost plates it only amounted to ·1–·09–·075 mm. The plates (figs. 5–9) were of the usual shape, with the usual wing-like development of the inner border of the body (figs. 7, 8), with rather blunt hook. The narrow rhachis had a fine fold (fig. 5, *a*). The innermost plates (fig. 5, *b*,*b*) were provided with a low and thick hook, the outermost (fig. 9, *a*) with slender hook and short body. The structure of the pulp of the radula was as usual (fig. 10).

The *salivary glands* (fig. 11) were yellowish-white, the anterior half much thicker (as much as 2 mm.) than the posterior, which is pointed towards the end. In the specimen examined, the posterior half was turned forwards, and the posterior end only was (fig. 11, *b*,*b*) bent round the large commissure. The entire length of the glands amounted to about 2 cm. The ducts of the salivary glands (fig. 11, *a*,*a*) were short.

The *œsophagus* (Pl. I. fig. 22, *a*) was about 13 mm. long by from 3–2 mm. in diameter; the inside showed the usual longitudinal folds. The œsophagus, which became a little widened behind into a sac 5 mm. long, communicating immediately with the biliary duct, opened into the wide stomach. The *stomach* itself (fig. 22, *b*) is nearly 13 mm. long by 12 mm. in diameter and 8 mm. high, the greater part of it projecting freely before the liver (fig. 22, *dd*); the inside has fine longitudinal folds. The *intestine* (fig. 22, *ccc*), which sprang from the anterior margin of the stomach, ran down in front of the anterior end of the liver, lying in a furrow on the latter, rose again a little way, and then, embedded in a continuation of the furrow, passed on the upper surface of the liver near the right margin to the anal papilla. The length of the intestine when extended amounted to fully 5 cm., and had an almost constant diameter of 2·5 mm. The inside of the intestine was provided with fine longitudinal folds. The whole digestive cavity, from the buccal cavity to the anal papilla, was filled with food, composed of a spongy siliceous mass with long spicules, and enclosing small corals, little pieces of conchylia, and a small well-preserved *Rissoa* (?), 4 mm. long.

The *posterior visceral mass* (liver) (fig. 22, *dd*) was large, about 2·6 cm. long by 2·1 cm. broad and 1·4 cm. high; the posterior end was rounded; the anterior truncated end broad, above (fig. 22) with a broad fissure (longer above) for the stomach, and below with a broad facet for the anterior genital mass; on the upper side was the narrow mesial furrow for the urinary chamber, not very deep and running rather obliquely; to the right the broader furrow for the intestine. The liver appeared uncovered here and there on the lower half of the anterior end and on the lower side, in the form of pale dirty yellow streaks; everywhere else it was covered by the ochre-yellow hermaphrodite gland. The hepatic cavity was pretty wide, with wide crypts. The *gall-bladder* lay at the posterior end of the stomach, showing a small roundish facet on the surface of the liver (fig. 22), about 5·5 mm. high, and opening right in the front into the hepatic cavity.

The *pericardium* was large; the *ventricle* of the heart 6 mm. long. The *blood glands* were loam-grey, very much flattened, and completely separated from one another by the ganglion-mass. The anterior gland 4 mm. in greatest diameter with a thickness of ·6 mm., was angularly round with truncated posterior end; the posterior 4 mm. long, tongue-shaped, the point turning backwards.—The *musculi retractores branchiæ laterales* about 12 mm. long, having several heads; between these, running parallel to them, were the four weaker *musculi retractores branchiæ medii*, which pass on to the anal papilla and to the posterior leaves of the gill.—The *renal syrinx* was about 3·5 mm. long, pyriform; the duct strong and thick-walled. The urinary chamber narrow; the kidney strongly developed.

The ochre-yellow *hermaphrodite gland* covered the greater part of the liver (*vide* supra); there were large oogene cells and zoosperma in the lobes. The duct of the hermaphrodite gland rose above the cardia, and ran upwards obliquely to the posterior side of the *anterior genital mass*. The latter was large, nearly 8 mm. long (from before backwards) by 6·5 mm. broad and 14 mm. high; the efferent ducts, moreover, projected nearly 3 mm. It was high, slightly compressed from the front backwards, with an external, anterior and posterior face; the prostate lies on the flattened lower side; the duct of the hermaphrodite gland runs down on the posterior side and forms the ampulla on the lower margin; the brown-yellow albumen-gland lies exposed in the middle behind the hermaphrodite duct; the spermatic duct, ascending to the penis, projects on the anterior side. The opaque yellow-white *ampulla of the hermaphrodite duct* (Pl. III. fig. 13, *a*), forms a series of flexions on the lower margin of the genital mass inside from the prostate; in the specimen examined it measured when extended 1·5 cm. long and ·7 mm. broad. The short male branch (Pl. III. fig. 13, *c*) passing into the yellowish-grey somewhat compressed *prostate* (fig. 13, *cd*); the first part of the latter was nearly 14 mm. long by 5 mm. in greatest diameter; the lower terminal end was nearly 6 mm. long, narrowed (like the upper), yellower, bent and attached to the preceding part. The cavity extending through the whole organ was narrow. The prostate became gradually smaller and passed into the *spermatic duct* (fig. 13, *e*), which was about 8·5 mm. long, tolerably

strong and slightly coiled, and passed into the much thicker penis, which was about 3 mm. long (fig. 13, *f*). The latter (the præputium) has strong internal, longitudinal folds; the opening of the spermatic duct lies above at the bottom of the cavity. The *spermatheca* was spherical, 8 mm. in diameter, nearly empty. The *spermatocyst* was sac-shaped, bent, 3·5 mm. long when extended (Pl. II. fig. 12, *a*), crammed with spermatozoa. The inner half of the uterine duct (fig. 12, *c*) was much thinner than the outer and than the vaginal duct (fig. 12, *b*). The *mucous gland* was white, showing very fine twistings throughout. The albumen gland was brownish-yellow, large, nearly half of it laid bare on the posterior side of the genital mass. The cavity of the mucous gland was empty; the duct showed the usual double fold, much higher towards its outer end.

From immediate comparison with the original specimen of *Discodoris morphæa*,[1] the form described above seems merely to represent a *darker variety* of the same, with much stronger and darker colouring of the dorsal side, and with confluence of the darker patches of the lower side of the mantle-border. One point may perhaps throw a doubt on the identification of the species, viz., the absence of stronger false median dental plates, of stronger thickenings on the rhachis,[2] which were distinctly wanting along the whole length of the rhachis in the individual here examined.

Platydoris, Bergh.

Doris (L.), d'Orbigny, Moll. des îles Canaries, 1834, p. 38.
Argus (Bohadsch), Mörch. Journ. de Conchyl., sér. 3, t. iii., 1863, p. 31.
Platydoris, Bergh, Jahrb. d. deutsch. Malacozool. Gesellsch., iv., 1877, p. 73.
„ Idem, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft xii., 1877, pp. 495–517, Supplementheft i., 1880, pp. 57–66.

Corpus coriaceum, rigidum, applanatum, circumferentia ut plurimum ovali vel rotundata, limbo palliali lato; nothæum minutissime granulatum. Apertura branchialis paucilobata, stellata; tentacula digitiformia; podarium margine anteriore bilabiatum, labio superiore profunde fisso.

Armatura labialis nulla. Lingua rhachide nuda, pleuris multidentatis, dentibus hamatis.—Prostata magna. Penis orbiculis duris hamigeris armatus; vagina armatura simili vel cuticula crassiori instructa.

This genus was established by me in 1877, and appears to form a very natural group.

These animals are usually of rather large size, roundish or oval, and depressed; the skin is hard and leathery; the dorsal surface granular; the edge of the mantle very large,

[1] The originals of Semper's collection of Nudibranchiata, mostly given to me by himself, were handed over by me to the collection in the University Museum of Copenhagen (Steenstrup).

[2] *Cf. loc. cit.*, p. 538, Taf. lxi. fig. 1, *aa*, *aa*.

the branchial aperture few lobed and stellate; the tentacles finger-shaped; the anterior margin of the foot bilobed, the upper lip cleft in the middle.—The labial disk is unarmed. The radula has a naked rhachis and a large number of hook-shaped lateral teeth. The præputium is armed with rows of hard flat disks, each bearing a hook; the vagina has a similar armature, or at least a strongly developed cuticle; the prostate is large.

Platydoris is not unlike *Asteronotus*, which differs, however, in being softer and smoother, and in possessing an unarmed penis and vagina, and a special dart and gland. *Hoplodoris*[1] comes near *Platydoris*, but differs in being softer, in the armature of the labial disk, and in possessing a dart like *Hoplodoris*. *Dictyodoris* agrees with *Platydoris* in the hardness of its outer skin, and in the unarmed labial disk, but differs in the smoothness of the dorsal surface, and in the unarmed condition of the penis; it has no dart.[2]

The genus is confined to the tropical seas. Not much is known about its habits, except that its movements are lethargic and slow. Quoy and Gaimard observed the copulation of *Platydoris scabra*, and the throwing off of pieces of the mantle in other species.[3]

The following list contains all the known or mentioned "species":—

1. *Platydoris argo* (Linné).
   Mediterranean.

2. *Platydoris philippi*, Bergh.
   Mediterranean.

3. *Platydoris angustipes* (Mörch).
   West Indies.

4. *Platydoris eurychlamys*, Bergh.
   ? *Doris solea*, Cuvier.
   Philippine Sea.

5. *Platydoris arrogans*, Bergh.
   Philippine Sea.

6. *Platydoris striata* (Kelaart).
   Indian Ocean.

7. *Platydoris ellioti* (Alder and Hancock).
   Indian Ocean.

[1] R. Bergh, Malacolog., Untersuch., *loc. cit.*, Supplementheft i., 1880, pp. 51–55.
[2] R. Bergh, *loc. cit.*, pp. 75–78.
[3] A similar phenomenon has been described in species of the genera *Discodoris* and *Peltodoris*.

8. *Platydoris formosa* (Alder and Hancock).
Indian Ocean.

9. *Platydoris brunnea*, Bergh.
Philippine Sea.

10. *Platydoris punctata* (d'Orbigny).
Atlantic Ocean (Canary Islands).

11. *Platydoris canariensis* (d'Orbigny).
Atlantic Ocean (Canary Islands).

12. *Platydoris variolata* (d'Orbigny).
East Pacific.

13. *Platydoris punctuolata* (d'Orbigny).
East Pacific.

14. *Platydoris scabra* (Cuvier).
Pacific Ocean.

15. *Platydoris* (?) *variegata*, Bergh.
Pacific Ocean.

16. *Platydoris vicina*, Bergh.
Pacific Ocean.

17. *Platydoris coriacea* (Abraham).
Indian Ocean (Seychelles).

18. *Platydoris inframaculata* (Abraham).
Indian Ocean (Amboyna).

19. *Platydoris tabulata* (Abraham).
Habitat ?

20. *Platydoris hepatica* (Abraham).
Pacific Ocean (Riciniola).

21. *Platydoris speciosa* (Abraham).
Indian Ocean (Amboyna).

22. *Platydoris murrea* (Abraham).
Indian Ocean (Mauritius).

23. *Platydoris* (?) *sordida* (Quoy et Gaimard).
Indian Ocean (Ile de France).

Platydoris eurychlamys, Bergh (Pl. II. figs. 18–24; Pl. III. figs. 1–12).

Platydoris eurychlamys, Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft xii., 1877, pp. 510–513; Taf. lix. figs. 11–18; Taf. lx. figs. 1, 2. Supplementheft i., 1880, pp. 61, 62; Taf. E. figs. 10, 11.

Habitat.—Philippine Sea (Samboangan).

A single specimen was taken on February 1, 1875, from a depth of 10 fathoms, at Samboangan, together with *Ceratosoma cornigerum* and *Discodoris morphæa*, and well preserved in alcohol.

The specimen, which was somewhat strongly hardened and rather bent, measured 8 cm. long by 4·8 in breadth and 1·6 cm. in height; the breadth of the mantle edge in front was 1 cm., at the sides and behind 2 cm.; the breadth of the foot about 1·5 cm., the length of the tail 6 mm.; the height of the rhinophorial bosses 2·5 mm., the apertures measuring about 2 mm.; the breadth of the branchial slit about 12 mm.; the height of the rhinophoria 6·5 mm., of the branchia 10 mm., and of the anal papilla about 5 mm.; the length of the tentacles 3 mm.—The *colour* of the whole upper surface brownish-grey; the sides of the body were about the same colour, as were also the margins of the foot, but still somewhat lighter; the under side of the mantle edge was a clear yellowish-white, so also the head and tentacles; the rhinophoria were greenish-grey, the leaves of the gill blackish-grey, but the rhachidian parts yellowish-white; the sole of the foot was yellowish-white.

The *form* of the body was much as usual. The broad mantle edge was undulated at its margin; the *dorsal surface* hard, somewhat rough to the touch, because it is covered all over with extremely fine knots. The *rhinophorial bosses* were about 5·5 mm. in diameter, with a crenate opening; the stem of the retracted rhinophore was about one-third of its whole extent; the club was provided with at least fifty broad lamellæ on each side. The wide branchial cleft was five-lobed, two in front, the largest behind, and one on either side; the height of the largest lobe was 6 mm. The branchia was made up of six tripinnate leaves; in front of the hindermost ones, and between them, was the cylindrical truncated *anal papilla;* close to the base of which, and slightly to the right, was the round *orifice of the renal organ.* The genital opening was strongly retracted. The anterior margin of the *foot* had a shallow furrow, the posterior end was rounded.—The peritoneum was quite colourless.

The strongly flattened *central nervous system* was enclosed in a narrow tough cap-

sule, which showed a white dotted appearance under the lens, due to the presence of a number of somewhat round yellowish hard cells, occasionally there were a few long spicules not strongly hardened. The upper surface of the ganglia was coarsely granular in appearance. The cerebro-pleural ganglia were reniform, the two divisions of about equal size and hardly distinguishable from each other; the pedal ganglia had a circular contour, and were about equal in size to the pleural. The large common commissure was hardly half as large as the diameter of the whole nervous system. The proximal olfactory ganglia (Pl. III. fig. 2, *a*) were nearly sessile and bulb-shaped; the distal form swellings about the same size upon the nerves (fig. 2, *b*). The buccal ganglia (fig. 1, *a*) were slightly smaller than the olfactory, egg-shaped, and united with each other directly; the gastro-œsophageal (fig. 1, *b*,*b*), being about one-sixth the size of the buccal, attached by a short stalk to the side of the nerve.

The *eyes* are attached by a short stalk to a hardly distinguishable ganglion; their pigment is black and the lens yellow. The *otocysts* are a trifle smaller than the eyes, and contain a quantity of otoconia, about two or three hundred of the usual kind; they are visible beneath the lens as chalk-white points. The broad, rather thin lamellæ of the *rhinophorial club*, as might be seen by a lens, were covered upon their surfaces, but not on their margins by small pigment spots; they contained numerous long rod-like pointed spicules, of a diameter of ·03 mm. scattered throughout. Through the stalk and on the walls of the cavity of the rhinophoria the tissue was filled with numerous quite similar spicules, sometimes rather stronger; the retractors of the rhinophoria were as in other species.[1] The *skin* of the back was filled everywhere with spicules like those just mentioned; the point-like knots on the back filled with spicules radiating outwards, and sometimes reaching the surface (Pl. II. fig. 21). In the *interstitial connective tissue* were generally a number of round hard cells,[2] but only exceptionally spicules.

The *buccal tube* had a yellowish-white colour, both inside and out; it was 6·5 mm. long by 5·5 mm. broad behind; the three pairs of retractor muscles had quite the usual form. The strong *bulbus pharyngeus* was 7 mm. long by 6·5 mm. in breadth and 6·7 mm. in height; the radula-sheath projected 3·25 mm. behind; the strong retractor muscles as usual. The arched labial disk was covered with a strong white cuticle; with a perpendicular mouth-slit somewhat wider above. The *tongue* was strong; the chitinous-yellow *radula* was provided with twenty-four *series of teeth*, within the radula-sheath and below the tectum radulæ there were twenty-seven fully developed and three undeveloped series; the total number being thus fifty-four. The first five or six rows were more or less incomplete; in the seventh there were on either side ninety-one teeth, and the same number in the twenty-fourth row; further back there was only an increase of at most two or three in the number of teeth to each series. The *teeth* were a clear yellow; the height of the three outermost was about ·09, ·1, and ·12 mm. respectively, and the

[1] *Loc. cit.*, p. 511.

[2] *Loc. cit.*, Supplementheft i., 1880, p. 61, Taf. E. fig. 10.

height of the plates increased gradually to ·3 mm., while the innermost of all (fig. 18, *a*,*a*) were only about ·1 mm. The shape of the teeth was as usual (Pl. III. fig. 6). The three outermost (Pl. II. fig. 19) had a very shortened body; the outermost (figs. 19, *a*,*a*, 20) upright, with a somewhat variable shape.

The *salivary glands* were about 2·8 cm. long and somewhat bent in the middle, the hinder end only reaching a short way beyond the large common commissure; in the most anterior part (Pl. III. fig. 11, *b*) they were yellowish in colour for an extent of about 6 mm., 2 mm. broad, and somewhat flattened; for the rest of their length (fig. 11, *a*) they were white and somewhat flattened, narrower in the hindermost portion, about ·3–·4 mm.; the cavity of the gland was quite narrow. The ducts short.

The *œsophagus* about 2·3 cm. long with a diameter of 1·5–2·3 mm. behind, and a little before its junction with the stomach the width was slightly greater (fig. 3, *a*); the interior had fine longitudinal folds. The sac-shaped *stomach* (fig. 3, *b*) extends some way in front of the cleft of the liver, and is about 1·5 cm. long by 1·2 cm. in breadth and ·8 cm. in height; its cavity communicates with that of the liver (fig. 3, *d*) by a very wide aperture; the interior is covered with close, low, longitudinal folds. The *intestine* takes its origin from the anterior end of the stomach (fig. 3, *c*), it immediately bends to the right, resting upon the œsophagus and anterior genital mass, then posteriorly it traverses a winding furrow upon the liver; its total length when fully extended is 6 cm., with a constant breadth of 2–2·5 mm.; the interior is covered with fine folds. The alimentary cavity was filled with the débris of food, generally consisting of indistinguishable animal remains, but sometimes of masses of sponges and Radiolaria-like convex bodies of 1·5 mm. in diameter.—The posterior visceral mass (*liver*) is 2·3 cm. long by 1·6 cm. in breadth and 1·4 cm. in height; the hinder end is rounded and truncate; the anterior end is obliquely inclined from above forwards and downwards, and hollowed out to receive the stomach; beneath on the right it has a facette for the anterior genital mass. About the middle line is the furrow for the intestine, and along its left margin the furrow occupied by the urinary chamber. The liver is darker inside than out, its colour is dirty yellow. The cavity has numerous wide crypts filled with food débris. The *gall-bladder* is of the same colour as the liver, pear-shaped, and situated on the left side of the stomach; it is 5·5 mm. long, with an average diameter of 2 mm. on the surface of the liver (the roundish facette is here somewhat sunken in the middle).

The *pericardium* is large and roundish; its length is 12 mm. and the breadth about the same; the walls thicker than usual (pathological ?), especially thickened round the margin.[1] The *ventricle of the heart* is 6 mm. long, and its upper surface covered with epithelial villi (fig. 10) of various size, found also on the auricle, and reaching a length of ·5 mm.; the two atrio-ventricular valves being strongly developed and the musculature of the

[1] In the pericardium I found the much mutilated female of a parasite belonging apparently to the genus *Briarella*, formerly instituted by me (Malacolog. Untersuch., *loc. cit.*, Heft x., 1876, p. 408, Taf. xlix. figs. 11–13) from a specimen

ventricle very strong. The *blood glands* are flattened and of a whitish-yellow colour, separated from each other by the central nervous system. The anterior is somewhat transversely-oval and bent in the transverse axis; its greatest diameter is 4·5 mm., its thickness 1·3 mm. The posterior gland is rather long, 7·5 mm., broader in front, about 6 mm. and 1 mm. thick.—The two strong *retractores branchiæ* are about 1 cm. long, and are made up of a number of separate but interlaced fascicles; their course is oblique.

The *renal syrinx* is short and melon-shaped, of a greater breadth than length, the greatest diameter being 2·5 mm; it is yellowish in colour; the interior has very strong longitudinal folds, which, by their yellow colour, contrast markedly with the brown-coloured arborescent villi of the duct; these latter (fig. 5) increase in size towards the lower part. The short and strong duct, of a greyish-brown tint, is conspicuously visible through the wall of the urinary chamber, which is 2·5–2 mm. broad anteriorly and about 3 mm. posteriorly. The anterior end of the chamber bifurcates at about the middle of the liver, and the right branch lies in the intestinal furrow; along the floor of the chamber runs on the right side about as far as this bifurcation, the thick duct of the renal syrinx (fig. 4, *b*), which at this place opens by a wide oblique cleft (fig. 4, *a*), conspicuous by its brown papillose tufts (fig. 4). The structure of the kidney was quite as usual.

The *hermaphrodite gland* covers the liver with a nearly continuous layer of a somewhat brighter colour; in the lobules of the gland are large oogenous cells and spermatozoa. The *anterior genital mass* is large and compressed, and somewhat heart-shaped, with an outer arched and inner more convex surface, and an obliquely flattened anterior surface; the upper and hinder margins sharper but rounded; the lower margin more flattened; the length of the entire mass about 14 mm. by 11·5 mm. in height, and 17 mm. in breadth. On the anterior surface are the vesiculæ seminales and genital ducts; the larger part of the inner side forms the dirty yellow albuminiparous gland, on the under side of which lies the ampulla of the hermaphrodite duct, winding farther forwards and outwards along the broad lower surface. The slender whitish *duct of the hermaphrodite gland* (fig. 12, *a*) winds above the exit of the main bile duct, traversing obliquely to the anterior genital mass, and forming a whitish coiled *ampulla* (fig. 12, *bc*), which, when unrolled, measured about 1·5 cm. with a diameter of some 1·5 mm. Theshort slender *male duct* (fig. 12, *e*) opens into the plano-convex heart-shaped *prostate* (fig. 12, *f*). This latter is about 3 mm. long, and has a narrow cavity. The first 8 mm. of the *vas deferens* (fig. 12, *g*) are thin, but it increases in thickness farther on and becomes muscular (fig. 12, *h*); the vas deferens then passes into the thicker *penis* (fig. 12, *ii*), cylindrical in form, and about 15 mm. long. For the whole of its length, the penis, and especially its *præputium*, is lined with a thick

found in *Ceratosoma trilobatum*. The female was 12 mm. long, of which 2·5 belonged to the tail, with six pairs of sac-like appendages of the abdomen. The form was very similar to that of *Briarella microcephala*. There were no egg-bags; on the wall of the pericardium, however, there were scattered a number of round or oval yellowish eggs ·1 mm. in diameter. I discovered also in the cavity of the pericardium three males, about 2–2·5 mm. long, like those I previously found in *Chromodoris elisabethina* (*loc. cit.*, Heft xi., 1877, p. 472, Taf. li. fig. 16A).

pale yellowish cuticle, which forms strong folds with here and there scattered disk-like structures. These *disks* are arranged in irregular (quincuncial) series, of which there are from 7 to 8 below and from 4 to 5 above; altogether, I found seventy-two of these disks. They are of roundish or oval contour, and both forms occur above (Pl. III. fig. 23) and below (Pl. II. fig. 9) within the præputium. Their greatest diameter varies between ·8 and ·25 mm., and plates of the two extreme sizes were found both above and below. The more or less arched upper surface (fig. 8) of the disks is prolonged into a hook, about ·18 mm. high, which is often very sharply bent; the stroma of the disk is frequently prolonged into the hook (Pl. II. fig. 24), in others the stroma seems to be withdrawn, leaving small air-containing spaces (fig. 24). At the base of the cavity of the præputium is the cylindrical *glans*, about ·8 mm. long, and covered with a simple cuticle; it is traversed by the seminal duct, opening by an oval aperture at its summit (fig. 23). As it passes into the vestibulum the præputium is strongly pigmented. At the lower end of the penis opens the whitish vestibular gland (Pl. III. fig. 12, *k*), about the size of the prostate, and rather compressed; it is sessile and has a largish cavity. The *spermatheca* (Pl. II. fig. 22, *a*) is spherical and about 6 mm. diameter, whitish in colour, and filled with semen and detritus. The stout vaginal duct is, including the long vagina (fig. 22, *b*), about 12 mm. long, and lined throughout by a strong yellow cuticle raised into 6–8 folds, which are especially strong in the vagina, and can be seen from the outside; the lowest end of the vagina (fig. 22, *c*) is brown coloured. The uterine duct (fig. 22, *dd*) is thinner and shorter than the vaginal, only 6 mm. long; at its lower end is the *spermatocyst* (fig. 22, *e*) attached by a short stalk; it is sac-shaped, yellow in colour, about 3·5 mm. in length, and was full of semen. The broad white upper margin of the *mucous gland* has fine gyri; quite in front there is a more yellowish portion; the rest of the outer side of the mucous gland is white, with a few thick windings. The larger part of the hinder side and the under margin was taken up by the large dirty yolk-yellowish *albuminiparous gland;* the duct of the mucous gland has the usual internal fold; the *vestibulum genitale* shows logitudinal folds.

In all probability the form described here is identical with the *Platydoris eurychlamys*, formerly investigated by me, though it presents a few differences, such as the greater number of disks in the præputium and their somewhat different form. An investigation of a number of individuals, however, would perhaps show a great variability in the armature of the penis; and perhaps the species *Platydoris vicina*, lately instituted by me,[1] may prove to be merely a variety of this.

Another specimen of the same species was dredged during the Challenger Expedition on the Reef of Tongatabu, from a depth of 8 fathoms. It was strongly bent; when

[1] Supplementheft i., 1880, pp. 62, 63, Taf. E. figs. 16–20.

straightened it measured 4·3 cm. The rhinophoria were deeply retracted but existed; the branchia and a large portion of the branchial cleft were missing, and all the alimentary tract as far as the buccal tube. Another animal had very likely entered through the branchial cleft, and had eviscerated its host.

Thordisa, Bergh.

Thordisa, Bergh, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. d. Philipp. Th. II. Bd. ii.), Heft xii., 1877, pp. 540–542.

Forma corporis fere ut in Discodoridibus; tentacula tuberculiformia; branchia paucifoliata.

Armatura labialis nulla. Lingua rhachide nuda, pleuris multidentatis; dentes hamati.—Penis inermis.

This genus, to which the species to be presently described can be only doubtfully assigned, is as yet but little known. In the general form of the body it comes near *Discodoris*, but differs in the entire absence of labial plates. The armature of the tongue, however, is similar; the rhachis is naked and provided with numerous lateral teeth, of the usual hooked form. The penis is unarmed.

The three following species which the genus contains are but little known; they are all tropical forms, but nothing is known of their mode of life.

1. *Thordisa maculigera*, Bergh.
   Philippine Sea.

2. *Thordisa villosa* (Alder and Hancock).
   Indian Ocean.

3. *Thordisa? clandestina*, n. sp.
   Pacific.

Thordisa clandestina, n. sp. (Pl. III. figs. 21–25).

Habitat.—Western Pacific (Torres Strait).

A single specimen was taken on September 8, 1874, at Torres Strait (Station 186, lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; bottom, coral sand).

The specimen was well preserved in alcohol.

Its *length* was 18 mm., breadth 9 mm., and height 6 mm.; the breadth of the mantle edge 3·5 mm., of the foot 6·5 mm.; the length of the tail 1·75 mm., the height of the extended rhinophoria 3 mm., of the (outstretched) branchia 2·5 mm. The *colour* was whitish; on the back were a number of brownish-black spots, which also were present and more abundant on the sides of the body and under-surface of the mantle edge; the

club of the rhinophore was of a greyish-chocolate colour, and the gill-leaves showed a similar colouring.—The animal was of a softish consistency.

The *form* of the body was a longish-oval, somewhat flattened; the dorsal surface quite even; the mantle edge projecting about 1–3·5 mm., and most strongly developed behind. The rhinophorial cleft oval, with a slightly prominent margin; the stem of the *rhinophore* is strong and somewhat compressed; the strong club, bent backwards, is about as long as the stalk, its upper side is somewhat flattened, the under somewhat keel-shaped, the number of leaves on each side is about twenty-five. The *branchial cleft* is transversely oval (of about 2·5 mm. diameter), with a slightly prominent reversed margin; the branchia is formed of five tripinnate leaves, of which the two hindermost are very deeply cleft, so that there appear to be seven divisions. Behind the branchial arch, and completing it, is the somewhat cup-shaped *anal papilla*, which has a crenate margin; at its base in front is the fine *renal pore*. The wrinkled genital papilla occupies its usual position. On either side of the stellate mouth-aperture is a strong knob-like *tentacle*, with a longitudinal furrow on the outside which is deeper at the end. The foot is rounded anteriorly and posteriorly, and does not stand out much from the sides of the body; on its anterior margin is a fine furrow.

The intestines are hardly visible from the exterior. The peritoneum is colourless.

The *central nervous system* is strongly flattened. The cerebro-pleural ganglia are longish; the line dividing the two parts is very distinct, especially on the outer margin; the pedal ganglia are larger than the pleural, and lie outside the middle part of the cerebro-pleural; they are of a short oval form and are almost divided into two parts. The common commissure composed of the three ordinary divisions; at the base of the hindermost (pleural) is a small ganglion genitale. The sessile bulb-shaped proximal olfactory ganglia are united with the equally sized distal by a winding nerve. The buccal ganglia are roundish, and about the same size as the last, united by a commissure so short as hardly to merit the name; a small swelling on the *nervus gastro-œsophagealis* represents its ganglion.

The *eyes* are nearly sessile, with black pigment and a yellow lens. The *otocysts*, visible under a lens as small chalk-white bodies, are about as large as the eyes, and are filled with a mass of brownish-yellow otoconia, each about ·02 mm. long (mostly possessing what appeared to be a nucleus). The broad, rather thin lamellæ of the *rhinophores* have no spicules. The *skin* of the back has no large spicules and but few hardened cells, which were also nearly absent in the *interstitial connective tissue*.

The *buccal tube* is strong, 3 mm. long, and has the ordinary three pairs of retractor muscles; its interior is as usual. The *bulbus pharyngeus* is strong, 3 mm. long by 2·5 mm. broad and 2·6 mm. high; the radula-sheath projects downwards about ·4 mm.; the strong retractor muscles are as usual. The *labial disk* has a covering of a thick white cuticle without any trace of armature; the mouth opening is four-rayed. The *tongue* is broad,

flattened, with a deep dorsal furrow; the yellow-coloured radula has sixteen series of teeth, the four anterior of which were incomplete, on the apex of the tongue there were traces of two other series that had become detached; further back, beneath the tectum radulæ and within the radula-sheath, were thirteen developed and three undeveloped series,—the total number being thus thirty-two. In the fifth series of the tongue there were seventy-six teeth on each side, and the number appeared not to increase much further back. The colour of the teeth is a clear chitinous yellow. The heights (Pl. III. figs. 22, 25) of the outermost (behind on the tongue) are about ·056–·07–·075–·08 mm.; the height then gradually increases to about ·12 mm., and then decreases again to ·8 mm. (fig. 21). All the teeth are of the usual simple form (figs. 23, 24), with the usual "winged" base; the outermost being more upright, with shorter base (figs. 22, 25, *aa*).

The *salivary* glands are yellowish and long (5 mm. by ·7 mm. broad), reaching to the under side of the stomach; in shape flattened and band-like; the efferent ducts short.

The *œsophagus* is short and wide, about 4·5 mm. long, with strong folds on its inner surface, which end obliquely at the cardia, but are prolonged into the stomach, where they are much more slightly developed. The *stomach* is large, about 6 mm. long by 4 mm. broad, and reaches as far as the *bulbus pharyngeus*. The alimentary tract was full of the remains of sponges and corallines, and other unrecognisable animal débris. The *intestine* arises from the anterior margin of the stomach, and runs straight backwards; its length is about 13 mm. and diameter ·75 mm.

The *liver* is about 7·5 mm. long by 5 mm. in breadth and 5 mm. in height; the broad anterior portion is obliquely truncated downwards, and is excavated to receive the hinder end of the stomach; the narrower hinder end is rounded. The colour of its upper surface is a clear grey, the tissue itself is dirty yellow coloured; the cavity large and round. I could find no gall-bladder.

The *heart* is large, the ventricle 2 mm. long. The *blood gland* lies behind the central nervous system, and is oval in form, whitish in colour, and slightly lobulated at its outer edge; its length is 2·4 mm.—The *renal syrinx* is yellowish-white, melon-shaped, and 1 mm. in greatest diameter, with strong interior folds visible from the outside. The *kidney* is strongly developed.

The *hermaphrodite gland* covers the liver; it contained no developed genital products. The *duct* takes its rise above the cardia; its ampulla is yellowish-white, and forms a slight swelling. The *anterior genital mass* was somewhat undeveloped, of an oval compressed form, barely 1·5 mm. long, and whitish in colour. The vas deferens is not long; the penis is unarmed. The state of the vesiculæ seminales I was unable to observe.

Whether this animal really belongs to the genus *Thordisa* or not must be left uncertain for the present. The smoothness of the body, and the shape of the outermost plates, seem to make the generic position of the animal somewhat doubtful.

Bathydoris, n. gen.

Corpus fere semiglobosum, molle; dorsum papillis conicis parvis ubique sparsis, margine palliali vix ullo; rhinophoria retractilia clavo perfoliato; tentacula sat magna, nonnihil applanata, acuminata; branchia e fasciculis discretis compluribus (6) fruticulosis non retractilibus formata; podarium sat latum.

Bulbus pharyngeus permagnus; armatura labialis nulla; mandibulæ magnæ, sat applanatæ, margine masticatorio lævi, processu masticatorio nullo; series radulæ multidentatæ, dens medianus nonnihil compressus, dentes laterales hamati, interni parte basali latiori, reliqui angustiori.—Penis conicus inermis, glande pagina inferiore fissura instructa.

This remarkable genus differs from all other Doridida proper in the *semiglobular form of the body*, which is something like the genus *Kalinga* of Alder and Hancock,[1] which it also resembles in the characters of its branchia *composed of several separate branchial tufts*, and in the development of soft conical papillæ upon the *back*. *Bathydoris* has no frontal appendages, and the dorsal margin is very slightly pronounced. In its internal structure, however, *Bathydoris* differs entirely from *Kalinga* and other Polyceradæ.

The gigantic *bulbus pharyngeus* differs from the same organ in all other Doridida, *and resembles rather that of Bornella*[2] and other Tritoniadæ; the labial-disk is unarmed, the *powerful mandibles are covered by a thick muscular mass*. The radula is not unlike that of the Tritoniadæ, possessing as it does a median tooth and a series of lateral teeth, but the first lateral tooth is quite similar to the rest, whereas in the Tritoniadæ it is different. The hermaphrodite gland is separate from the liver, as in *Bornella* and *Scyllæa*. The penis is unarmed as in the Tritoniadæ. *Bathydoris* appears to form a *remarkable connecting link between the Tritoniadæ and the Doridida*, with which latter group it agrees in possessing a *blood gland*.

Bathydoris abyssorum, n. sp. (Pl. XII. figs. 14–20; Pl. XIII. figs. 1–25; Pl. XIV. figs. 1–15).

Corpus quasi subgelatinosum, subpellucidum. Rhinophoria et tentacula brunnea, branchia et genitalia externa aurantiaca, podarium e nigro purpureum.

Habitat.—Pacific.

One specimen of this large species was taken in the middle of the Pacific, at Station 271, lat. 0° 33′ S., long. 151° 34′ W., from a depth of 2425 fathoms; bottom temperature, 1°·0 C.; bottom, globigerina ooze. The specimen was fairly well preserved in alcohol.

According to Mr. Murray's notes "the body of the *living animal* was gelatinous and

[1] Alder and Hancock, Notice of a Collection of Nudibranchiate Mollusca made in India, *Trans. Zool. Soc.*, vol. v. part 3, 1864, pp. 134–136, pl. xxxii. figs. 7–10.

[2] Bergh, Malacolog. Untersuch., *loc. cit.*, Heft vii., 1874, pp. 289–308.

transparent, the tentacles brown, the gills and protruding external generative organ orange, the foot dark purple."

The length of the specimen (somewhat contracted no doubt) is 12 cm., its breadth 10·5 cm., and height 7 cm.; the length of the foot 6·5 with a breadth of 4·5 cm.; the length of the tentacles and rhinophoria nearly 2 cm., and of the projecting glans penis 1·5 cm.; the height of the branchial tufts nearly 1·5 cm. The *colour* of the body, together with the branchia, a greenish-white, the rhinophoria greenish-grey, the head and tentacles brownish-grey, the projecting external genitalia yellowish-white; the quite narrow sides of the body and the foot black.

The body (Pl. XIII. fig. 1; Pl. XII. figs. 14, 15) is nearly spherical in shape, somewhat like a gigantic *Onchidiopsis;* there is no trace of a dorsal margin or distinct line dividing the back from the sides, but near the base of the foot all round the body the small elevated figures of the back were entirely absent; this region of the body is quite smooth, and passes anteriorly into the neck (fig. 14); it answers to the sides of the body in other Dorididæ. The *back*[1] is very convex, densely covered with small, scarcely elevated disk-like figures, each with a fine aperture surrounded by an areola with a raised margin; these figures are round or oval in form, the largest measuring 2·5 mm. in diameter; towards the periphery they decrease in size (figs. 14, 15); between them were a number of small papillæ, in height from ·5 to 2·5 mm., the former disks are no doubt the remains of other papillæ that have been lost (Pl. XII. fig. 16). At the anterior end are the *rhinophoria*, which were in this specimen fully extended, and the rhinophorial cavities reduced to a slightly prominent even margin; the stems of the rhinophoria (fig. 14, *a*,*a*) are strong and short, their club-shaped extremities elongated, with about 100 more or less complete narrow leaves on either side, the two series on the back side separated from each other by a dorsal prolongation of the stem. The flattened rather small *branchial tufts* are situated posteriorly, two on the right side and three on the left; probably the missing branchial tuft on the right hand side had been accidentally lost, since the remains of the stem (fig. 15) were visible. Each branchial tuft consists of four unequal tri- or quadripinnate leaves, which diverge from a common stalk; in the uppermost gill on the left side the stems bearing the small gill-leaves were separate, each bearing two leaves. Behind the last branchia, and completing in this way the branchial circle, is the *anal papilla*, situated in the middle line of the body, and directed backwards and downwards; the anal aperture is stellate (fig. 15). In front of the anus, close to the posterior right interbranchial space, is the prominent *renal papilla* (fig. 15). The *frontal margin* of the back is but slightly developed, and has no trace of appendages, and entirely disappears below (fig. 14). The *sides of the body* are very low. The *genital openings* are very conspicuous, and surrounded by a raised margin 11 mm. high (fig. 14); from the anterior

[1] There were two large lacerated holes on the back (2 cm. and 1·4 cm. in diameter respectively), through which a great part of the liver had been lost.

orifice projected the strong glans penis; through the posterior orifice opens the duct of the mucous gland, and the aperture was partly filled by the bifid fold of the duct. The *foot* (figs. 14, 15, *b*) is strong and broad, projecting about 10 mm. from the sides of the body; the anterior end of the foot is truncate, rounded in outline; it has a fine marginal furrow; the tail is short, about 1·5 cm. long.

The *central nervous system* is situated on the anterior part of the upper side of the bulbus pharyngeus; it is depressed and small; the length of the cerebro-pleural ganglia is about 7 mm. The *cerebral* ganglia (Pl. XIV. fig. 4, *a*,*a*) are broader anteriorly, and give off four nerves from the anterior border, one nerve running backwards from the external margin and two nerves from the upper surface, one of which is fine and delicate and the other stout and swollen into a ganglion at its base (ganglion opticum ?); no nerves appeared to take origin from the under surface. The *pleural* ganglia (fig. 4, *b*,*b*) are about equal in size to the cerebral; each is divided by a deep fissure into a smaller inner and larger outer portion; the latter alone gives rise to nerves—a thin delicate strand from the upper surface, and from the posterior margin four nerves, two of which are considerably stouter than the others; from the under surface spring three delicate nerves (fig. 4). The *pedal* ganglia (fig. 4, *c*) are hardly smaller than the cerebro-pleural, and oval in shape; the cerebro-pedal and pleuro-pedal connectives are separated by a distinct cleft (fig. 4); from the internal margin of the ganglion two nerves proceed, of which one was considerably stouter than the other; from the external margin four nerves arise, the anterior one being the stoutest; the *commissure* uniting the two pedal ganglia (fig. 4, *h*) springs from the postero-external margin of each, and shows an indistinct division into two or three bundles. The cerebro-buccal connective (fig. 4, *e*,*e*) is rather long; the *buccal ganglia* (Pl. XIII. fig. 2; Pl. XIV. fig. 4, *f*,*f*), situated upon the sides of the œsophagus, are large and oval, measuring about 4·25 mm. in length; each gives off four nerves, three posteriorly and one anteriorly; the commissure uniting the two (fig. 4, *g*) was unusually long (about 2·2 cm.), no trace of a gastro-œsophageal ganglion was detected. The nerve cells of the cerebral ganglia measured as much as ·28 mm.

I found no trace of eyes or otocysts.[1] The axial channel of the *rhinophoria* was wide and showing numerous variously sized apertures on the walls; the nervus olfactorius strong and somewhat swollen at the base of the club, forming a rudimentary olfactory ganglion (?); there were no spicules in the leaves of the club; the two retractor muscles of the rhinophorion were very strongly developed. The *skin* proper of the back is easily separable from the next layer, and shows a number of perforations, which correspond to the disks mentioned above, which are certainly merely

[1] Although after a careful examination I have not been able to detect eyes or otocysts, it is possible that both will be eventually found. On the "abyssal theory of light" there is no reason to doubt their presence. Eyes have been detected in a species of *Pleurotoma* dredged from a depth of 2090 fathoms, and in a *Fusus* from 1207 fathoms (Wyville Thomson, The Depths of the Sea, 1873, p. 465. K. Semper, Die natürl. Existenzb. d. Thiere. Bd. i., 1880, pp. 103, 262; Animal Life, Internat. Sci. Series, p. 420, 1881).

the scars left after the falling off of the papillæ, which during the life of the creature, no doubt, cover the whole of the back. The *papillæ* (Pl. XII. figs. 14, 15; Pl. XIV. figs. 1–3) consist of a layer of circular muscle bundles surrounding another perpendicular layer; transverse sections of the papillæ showed a number of apertures, corresponding to the vessels and nerves (fig. 3, *a*), which ramify in their interior, and are occasionally accompanied by a renal branch; on the surface of the papillæ are a number of small unicellular glands. The scars left after the removal of the papillæ display a somewhat yellowish double contour, the outer line corresponding to the circular, and the inner to the perpendicular muscular coat; the central orifice was yellowish, and contained the nerve. When the whole of this layer is removed, another appears which displays a branching network of nerves and ganglia (Pl. XIV. fig. 5), partly visible with a hand-lens, which gives off twigs to the papillæ; on the surface of this layer are a number of depressions answering to the perforations of the upper layer; beneath the nervous "rete" is a layer of muscular bundles crossing each other in all directions. The deepest layer, which follows the last-mentioned, is also provided on its surface with a nervous ramification, beneath which are longitudinal and transverse muscles. Beneath this comes the *peritoneum*, which is easily separable, and is in this region of the body milky-white in colour, owing to the presence of an irregular meshwork of the fine whitish renal tubules (Pl. XII. fig. 20). There were no spicules in the skin.

The *mouth tube* is strong and thick-walled, and about 1·5 cm. long.—The *bulbus pharyngeus* (Pl. XIII. figs. 2–6) is unusually large (5·8 cm. long, 5 cm. in height, and 4·2 cm. in breadth); the radula-sheath, situated on the posterior portion of its under surface (figs. 2, *c*, 6, *c*), is about 23 mm. long by 17 mm. broad and 7 mm. high. The organ is divided all around into two halves by a prominent rather sharp edge (the margin of the mandibles) (fig. 3); the anterior half is smaller and narrower, and comes to a point in front; the posterior half is rounded behind in the neighbourhood of the large radula-sheath; the upper surface dips downwards, in front somewhat obliquely, and is still more inclined posteriorly (Pl. XIII. fig. 2); close to the top is the origin of the œsophagus, and on each side of this are the openings, one on each side, of the salivary glands (fig. 2, *d*). The anterior part of the upper side is flattened, broader upwards, narrower downwards (fig. 3); the posterior part is broad and somewhat convex behind the pharynx (fig. 3). The anterior part of the sides of the bulbus pharyngeus forms an angle with the upper surface, and in the neighbourhood of the edge is depressed; along the edge the posterior portion shows a deep depression, elsewhere it is convex. The lower surface of the bulbus pharyngeus is convex, with a slight depression at the entrance of the arteria lingualis; the posterior part is broader, with a strong prominence on each side of the radula-sheath (fig. 2). The colour of the bulbus pharyngeus is a dirty yellowish-red, inclining to red on the under side and posterior extremity; the anterior half of the upper side is whitish, and has a nacreous appearance. Several strong *adductor*

muscles (fig. 2) pass forwards from the posterior part of the upper surface, and are attached to the labial disk. The *labial disk* is of oval form, about 2 cm. long (fig. 2, *a*, 3, *a*); each of the two halves of which it is composed measures about 7 mm. in diameter; it is whitish in colour; the inner edge is irregularly wrinkled; the mouth is a perpendicular slit, with bluish-black walls.—The upper commissure of the mouth having been divided in the middle line as far as the mandibles (fig. 6), the length of that portion of the bulbus lying in front of the mandibles was 2 cm. It was lined by a very thick (4·5 mm.) cuticle (fig. 6, *b*), which presented the usual finely striated and stratified structure, and was blackish in colour at the outside and at its somewhat attenuated fore-end passed into reddish-brown on the inside. The cuticle is firmly fixed along a part of the anterior end of the mandibles, over which it passes, to become continuous with the cuticle lining the deeper part of the buccal cavity, where it is again firmly fixed to the mandibles in the region corresponding to the insertion on the foreside (fig. 6). These mandibles appear with their free part, yellow-green in colour, at the bottom of the above-mentioned anterior part of the buccal cavity; the right mandible overlaps the left, a small portion only of which was therefore visible (fig. 4). On removing the cuticle from the strong muscular mass, the inner surface of the latter was visible, traversed by a series of longitudinal folds (which correspond to furrows on the cuticle). The muscular mass increases in thickness posteriorly; the flattened, concave, whitish, hinder extremity resting on the foreside of the mandibles; the diameter of this part was 13–14 mm. The mass is made up of an external circular and an internal longitudinal layer.—The *mandibles* are very large, about 4·4 cm. long by 2·8 cm. broad and 1·4 cm. high. The greater part is concealed within the bulbus, and is of an opaque, milky-yellow appearance, whitish in front and more yellow behind. The free portion is yellowish-green, darker on the backside, and covered with very fine radial striæ. In shape the mandibles are oval (figs. 4, 5), with an angle at the middle of the internal margin; the thickness (at the middle) is about 3 mm., gradually thinning towards the margins, and eventually being only ·4–·3 mm. in thickness. The upper and lower ends are rounded; the external margin is convex and thin, the internal straighter and rather thicker; about the middle it gives off a rounded tooth (fig. 5); the surfaces are smooth and finely striated concentrically and radially. On the lower part of each mandible is a thickened portion, forming a tubercle on both sides (fig. 5). The mandibles are not united by a hinge, although there exists a rudiment of this in the shape of a thickening on the upper part of the internal margin, but by the cuticle already mentioned which passes from one mandible to the other (fig. 4). Both sides of the enclosed portion of the mandibles are covered by a thick epithelium of thin cylindrical cells measuring ·08 mm. When the epithelium is removed, the colour of the mandibles is seen to be a fine canary-yellow, contrasting with the greenish colour of the free portion (of a breadth amounting to 10–12 mm.). The masticatory edge was worn, but did not appear ever to have possessed denticulations.—

The removal of the mandibles lays bare the *anterior portion of the muscular mass*, which bears the impress of their form. In the upper half the internal margin forms a thinner wing of about 3 mm. in breadth.—The walls of the hinder part of the buccal cavity, and the tongue for the most part, are reddish-brown, inclining to black; the tectum radulæ is black.—The *tongue* (fig. 6) entirely fills the hinder part of the buccal cavity, and is of the usual form, with a deep median cleft; the length of the tongue is about 2·6 cm., its breadth 3·5 cm., and its height 2·6 cm.; the *radula* is glittering blackish-brown, yellower within the sheath. The radula is made up of fifty-four or fifty-five series of teeth; further back there are sixteen fully developed and four not fully developed series; the total number is thus seventy-five; the radula and its continuation in the sheath have, when removed, an entire length of 4·5 cm., the breadth of the hinder part, when expanded, being 4·5 cm. The twenty anterior series of teeth were incomplete, specially on the median and outermost parts (Pl. XIII. figs. 23, 24); in the youngest series there were 128 to 130 on each side of the median tooth. The length of the youngest median plates is about ·5 mm. by a height of ·25 mm.; the height of the first lateral plate was about ·43 mm.; the length of the basal portion of the lateral plates increasing to ·8 mm. by ·58 mm. in height; the length of the nine outermost teeth was ·2, ·22, ·25, ·28, ·3, ·35 mm. up to ·4 mm.; the height of the outermost plate about ·35–·4 mm. The colour of the teeth is chitinous yellow, becoming darker at the basal portion; the teeth within the sheath much lighter in colour than the others. The *median tooth* has an elongate quadrangular basal portion, the middle of the posterior margin being more (Pl. XIII. figs. 7–9; Pl. XIV. fig. 6, *a*) or less (Pl. XIV. fig. 7) prominent; the anterior part of the tooth rises in an obliquely directed short strong hook, the posterior margin of which is somewhat excavated at the base. The first four or six *lateral plates* are rather broader than the rest, and have a shorter hook (Pl. XIII. figs. 10–15); the first (Pl. XIV. fig. 6, *b*) often has a median prominence (Pl. XIII. fig. 7*b*, *b*), just as in the median teeth. The teeth then gradually assume the normal form, but often show remarkable irregularities, especially in the breadth of the basal part (figs. 16, 17); the fourth or fifth is remarkable in this respect (fig. 13). All the following lateral teeth are of the same shape, with a rather narrow basal part (Pl. XII. fig. 19), and with the hook oblique, somewhat crooked pointed, and narrower in the back than the base (fig. 16). There are frequently irregularities, which sometimes take the form of a coalescence of two teeth (Pl. XIII. fig. 22); sometimes the hook is shorter than usual (fig. 16, *a*), or completely absent; occasionally (fig. 22) the back is deeply excavated. In the exterior sixth or seventh part of the series the size of the teeth gradually decreases (Pl. XII. fig. 19), mainly owing to the diminution in size of the hook, which in the outermost is quite rudimentary (Pl. XIV. figs. 9, 10).

The *salivary glands* are whitish and somewhat flattened, as far as could be made out, and rather short; the salivary ducts are strong, and about 10–12 mm. long (Pl. XIII. fig. 2, *d*).

The *œsophagus* (Pl. XIII. fig. 2, *e*) is short and wide, about 2 cm. long, the inside pro-

vided with numerous longitudinal folds (fig. 6), which are not continuous with those of the stomach. The *stomach*[1] is large, free, and consists of an anterior narrower and a posterior somewhat wider portion; the former is about 3·2 cm. long, by 2·4 cm. broad and 1·5 cm. high; the latter about 5·2 cm. long, by 4·5 cm. broad and 3 cm. in height; the former is reddish-grey on the outside, the latter greenish-grey with a nacreous lustre, it is provided with numerous muscular bands; the interior of nearly the whole organ is blackish-violet in colour, and has numerous strong longitudinal folds; the posterior end is smooth and greenish-grey in colour; at the posterior end above is the aperture of the bile duct. The wall of the stomach is 3–3·5 mm. thick; that of the intestine 2–·5 mm. The *intestine* is strong and long (20 cm.); its diameter is everywhere about 10–12 mm.; it arises from the fore-end of the stomach, and takes the usual course to the anus; its interior is nearly smooth; with only a few folds which increase in thickness in the rectum.—The whole alimentary tract was completely empty, with the exception of the intestine, which contained a softish dark violet mass, made up of indistinguishable animal remains with a large (2·7 cm. long) pyriform body, possibly an animal allied to *Actinia*.

The *liver* was apparently about the same size as the stomach, and had a large cavity; the interior was of a brownish-black, the exterior of a dirty-grey, colour.

The *pericardium* is very large. The *atrium* of the *heart* broad and large; the ventricle has a length of 26 mm., a breadth of about 42 mm.; there is a thin-walled dilatation along its left margin; the *atrio-ventricular valves* are strong and about 4 mm. broad; the orifice of the aorta is unprovided with valves. The *blood glands* are of a yellowish-white colour, faintly tinged with green; they lie obliquely on each side of and above the pharynx, the left hand one being slightly in advance of the other; the left hand gland has a length of about 27 mm., with a breadth of 18 mm. and a thickness of 10 mm; the right hand gland a length of 35 mm., a breadth of 32 mm., and a thickness of 6 mm.

The *renal syrinx* is of a reddish-brown colour, pyriform in shape, and about 1 cm. long, with the usual folds on the inside; its pericardial orifice has a diameter of about 1·5 mm. The free part of the *ureter* is 4 cm. long, and is provided with folds and papillary outgrowths on the inside (Pl. XIII. fig. 25); that portion of the duct which lies within the body-wall, ending in the renal pore, is about 2 cm. long. On the peritoneum is a dense ramification of renal tubules (Pl. XII. fig. 20). On the surface of the liver there seemed to be a large and beautiful feather-like organ, which must be regarded as the kidney and the urinary chamber.

The *hermaphrodite gland* (Pl. XIV. fig. 11) was quite free, and lay, as it seemed, between the liver and the anterior genital mass, forming an irregular parallelogram-shaped organ, its length was 3·3 cm., with a breadth of 2·3–3 cm. and a height of about

[1] There were two large openings on the back, possibly produced by the distension on bringing the animal up to the surface from the great depth at which it lived. Unfortunately both the stomach and liver were here ruptured, and their connection broken, hence I am unable to make any positive statements concerning the relations of these organs and the exact situation of the hermaphrodite gland and renal chamber.

·8 cm.; the upper surface is covered by the reddish-grey peritoneum; the colour of the gland is yellowish-white, the surface granular; the larger granules are spermatic, the finer ones on their surface ovarian (fig. 12); the spermatozoa are of the ordinary form, the head measuring from ·009–·013 (fig. 13) mm., the minute ducts of the lobules are visible between the granules. From the inferior surface of the gland the strong hermaphrodite duct takes its origin (fig. 11).—The *anterior genital mass* is large, and measures 6 cm. in length by 5 cm. in height, and 3·5 cm. in thickness; the efferent ducts (2 or 3 cm.) prominent. The right side is very convex, thicker in front than behind; the inner (left) side flattened through contact with the bulbus pharyngeus, and somewhat hollowed out; the upper surface straight and rather flat; the under surface rather convex, but broader and flatter in front; the hinder end being more sloping and rounded. The hermaphrodite duct is about 4·5 cm. long, and, passing over to the hinder part of the anterior genital mass, forms a coil on the upper part of its right side about 4 cm. long; the diameter of the duct is about 3 mm., it continues its course to a short distance from the root of the large duct of the mucous gland, where it divides in the usual way. The *vas deferens*, issuing from the hermaphrodite duct, pursues a winding course to the præputium, where it forms a dense coil (Pl. XIV. fig. 14, *a*); when unrolled the duct measures about 7 cm. long by about 1·6 mm. in diameter. The *præputium* has a length of some 3·5 cm. with a uniform diameter of 2·2 cm., the thickness of its walls is about 1·5 to ·5 mm.; the cavity is almost filled by the large *glans* (Pl. XII. fig. 14, *c*), which has a length of 3·7 cm. and a breadth at its base of 1·9 cm.; in form it is conical, somewhat flattened on the under surface, where there is a long, wide, oblique cleft (Pl. XIV. figs. 14, 15), continued backwards into a wide cavity without any hole at the bottom; the continuation of the vas deferens, much coiled, could be followed along the whole of the upper side of the glans (fig. 15) into a small round opening at its point (figs. 14, *c*, 15, *c*); there was no trace of any armature of the glans or vas deferens. The glans is muscular, and contains large longitudinal vessels or lacunæ, especially developed towards the point, and a thick nerve. The cuticle on the cleft of the gland was colourless and quite smooth. The *spermatheca*, as far as could be made out, is roundish and flattened in form, of about 18 mm. diameter; it was quite empty and nearly concealed by the windings of the ampulla; its vaginal duct is no thicker than the vas deferens, and of about the same length as the organ itself. The *spermatocyst* lies beneath the windings of the hermaphrodite duct, and is whitish in colour, flattened, and of a rounded contour, 13 mm. in diameter; it was full of spermatozoa. The *mucous gland* is whitish in colour, with a tinge of green at its hinder part; the *albuminiparous gland* of a pale yellow; the *duct* of the mucous gland is about 3·5 cm. long and 1·7 cm. in diameter, the upper portion has (fig. 14) on its inner surface a number of longitudinal folds; the very strong, deeply furrowed fold (Pl. XII. fig. 14, *c*) is chalk-white.

Family Doriopsidæ.

This interesting Family, which has only been studied of late years, seems to be derived from the Doridida. In internal structure these animals are closely allied to the Phyllidiadæ, from which group, however, they differ greatly in external form, and have been united with them to form the group Porostomata.[1]

The Family consists of two genera—*Doriopsis* and *Doriopsilla*.[2]

Doriopsis, Pease.

Doriopsis, Pease, Proc. Zool. Soc. Lond., 1860, p. 32; Amer. Journ. Conchol., vol. vi., 1871, p. 299.
„ P., Bergh, Neue Nacktschnecken der Südsee, I. Journ. d. Mus. Godeffroy, Heft viii., 1875, pp. 82–94, Taf. x. figs. 21–23; Taf. xi. figs. 2–24.
„ P., Idem, Malacolog. Untersuch. (*in* Semper, Reisen im Archip. der Philipp. Th. II. Bd. ii.), Heft x., 1876, pp. 384–387; Supplementheft i., 1880, pp. 9–13.
„ Idem, Die Doriopsen des Atlant. Meeres., Jahrb. d. deutsch. Malacozool. Gesellsch., Bd. vi., 1879, pp. 42–64.
„ Idem, Die Doriopsen des Mittelmeeres, Jahrb. d. deutsch. Malacozool. Gesellsch., Bd. vii., 1880, pp. 297–328, Taf. 10, 11.
Doridopsis, Alder and Hancock, Trans. Zool. Soc. Lond., vol. v., part 3, 1864, pp. 124–130, pl. xxxi.
„ Idem, Trans. Linn. Soc. Lond., vol. xxv. part 2, 1865, pp. 189–207, pls. xv.–xx.
Haustellodoris, Pease, *loc. cit.*, 1871, p. 300.
Rhacodoris, Mörch, Journ. de Conchyl., ser. 3, t. iii., 1863, p. 34.
Hexabranchus, Gray (*nec* Ehrb.), Figs. of Mollusc. Anim. 1850, vol. iv. p. 164.

Corpus sat molle, forma fere omnino ut in Doridibus propriis. Apertura oralis poriformis; tentacula brevissima, affixa; rhinophoria et branchia ut in Doridibus propriis. Nothæum læve vel tuberculatum, limbo palliali ut plurimum latiori undulato. Podarium latum, ut in Doridibus propriis.

Bulbus pharyngeus elongatus suctorius mandibula et lingua destitutus.—Penis hamis seriatis armatus.

This genus was established by Pease in 1860, but its identity with the *Doridopsis* of Hancock was not made clear until the appearance in 1871 of another publication by Pease, where this author directly accentuated this identity. Hancock gave some account of the anatomy of this form, upon which I have myself contributed memoirs.

In external characters *Doriopsis* is very similar to *Doris*, but may be distinguished by its softer consistency and the undulated margin of the mantle; the mouth is a fine pore; the tentacles at the sides of the mouth are short and form a slight fold; the retractile rhinophoria and branchia are like those of *Doris;* the branchial leaves are tri- or quadri-

[1] Bergh, Malacolog. Untersuch., *loc. cit.*, Heft x., 1876, title page.

[2] Bergh, Die Doriopsen des Mittelmeeres, *Jahrb. d. deutsch. Malacozool. Gesellsch.*, Bd. vii., 1880, pp. 316–326.

pinnate; the foot is large as in *Doris*. In internal structure, however, this genus is widely removed from *Doris*, and resembles more closely the Phyllidiadæ. In the central nervous system the ganglia are very concentrated. The bulbus pharyngeus is elongated and tube-like, the buccal ganglia and salivary glands lying at its hinder end; there is no trace of mandibles or tongue, the bulbus itself forming a suctorial organ. There is a large inferior ptyaline gland.[1] In the pericardium is a special system of gill-leaves. There is a large sanguineous gland. The liver is deeply cleft at its posterior end (for the retractor branchiæ longus muscle). The hermaphrodite gland covers the liver; a spermatheca and spermatocyst are present; the end of the spermatic duct and the glans are armed with series of small hooks.

The genus is confined to the tropics, or at least the warmer seas; nothing is known of its habits and mode of life. The ribbon-shaped *spawn* of a few species has been detected, but nothing is known of their development.

The following is a list of the species that have been described:—

1. *Doriopsis nebulosa*, Pease.
   Pacific Ocean.

2. *Doriopsis scabra*, Pease.
   Pacific Ocean.

3. *Doriopsis viridis*, Pease.
   Pacific Ocean.

4. *Doriopsis affinis*, Bergh.
   Pacific Ocean.

5. *Doriopsis tristis*, Bergh.
   Philippine Sea.

6. *Doriopsis rubrolineata*, Pease.
   Pacific Ocean (Huaheine Islands).

7. *Doriopsis tuberculosa* (Quoy et Gaimard).
   Doris carbunculosa, Kelaart.
   Pacific and Indian Oceans.

8. *Doriopsis australis* (Angas).
   Pacific Ocean.

[1] With respect to the acidogene nature of the glandulæ ptyalinæ and salivales: see, Krukenberg, Vergl. physiolog. Studien, Bd. v. 1881, pp. 69–70.

9. *Doriopsis denisoni* (Angas).
Pacific Ocean.

10. *Doriopsis rubra* (Kelaart), Hancock.
Indian Ocean.

11. *Doriopsis fusca*, Alder and Hancock.
Indian Ocean.

12. *Doriopsis gemmacea*, Alder and Hancock.
Indian Ocean.

13. *Doriopsis pustulosa*, Alder and Hancock.
Indian Ocean.

14. *Doriopsis clavulata*, Alder and Hancock.
Indian Ocean.

15. *Doriopsis atromaculata*, Alder and Hancock.
Indian Ocean.

16. *Doriopsis punctata*, Alder and Hancock.
Indian Ocean.

17. *Doriopsis miniata*, Alder and Hancock.
Indian Ocean.

18. *Doriopsis nigra* (Stimpson), Hancock.
Indian Ocean.

19. *Doriopsis krebsii* (Mörch).
Doriopsis krebsii, var. *pallida*, Bergh.
West Indies.

20. *Doriopsis limbata* (Cuvier).
Doris inornata, Abraham.
Mediterranean.

21. *Doriopsis grandiflora* (Rapp).
Doris setigera, Rapp.
Doris rappii, Cantraine.
Mediterranean.

22. *Doriopsis gibbulosa*, Bergh.
Pacific (New Caledonia).

23. *Doriopsis nicobarica*, Bergh.
Indian Ocean.

24. *Doriopsis semperi*, Bergh.
Philippine Sea.

25. *Doriopsis modesta*, Bergh.
Philippine Sea.

26. *Doriopsis pellucida*, Bergh.
Philippine Sea.

27. *Doriopsis pudibunda*, Bergh.
Philippine Sea.

28. *Doriopsis maculigera*, Bergh.
Philippine Sea.

29. *Doriousis albo-limbata* (Rüppell und Leuckart).
Red Sea.

30. *Doriopsis fumata* (Rüppell und Leuckart).
Red Sea.

31. *Doriopsis peruviana* (d'Orbigny).
East Pacific.

32. *Doriopsis fontainii* (d'Orbigny).
East Pacific.

33. *Doriopsis violacea* (Quoy et Gaimard).
Pacific Ocean (New Holland).

34. *Doriopsis fumosa* (Quoy et Gaimard).
Indian Ocean (Isle de France).

35. *Doriopsis debilis* (Pease).
Pacific Ocean (Huaheine Islands).

36. *Doriopsis compta* (Pease).
Pacific Ocean (Apaiang).

37. *Doriopsis sordida* (Pease).
Pacific Ocean (Tahiti).

38. *Doriopsis atropos*, Bergh.
West Atlantic (Rio Janeiro).

39. *Doriopsis grisea*, Bergh.
Pacific Ocean (Huaheine Islands).

40. *Doriopsis lacera* (Cuvier).
Doris wellingtonensis (Abraham).
Pacific Ocean (New Zealand).

41. *Doriopsis indacus*, Tapparone-Canefri.
Japanese Sea[1] (Yokohama).

42. *Doriopsis fuscescens* (Pease).
Pacific Ocean (Maiao Islands).

43. *Doriopsis australiensis*, Abraham.
Habitat ?

44. *Doriopsis obscura*, Abraham.
Habitat ?

45. *Doriopsis fumea*, Abraham.
Habitat ?

46. *Doriopsis fœdata*, Abraham.
Habitat ?

47. *Doriopsis subpellucida*, Abraham.
West Indies (St. Vincent).

48. *Doriopsis mammosa*, Abraham.
Habitat ?

[1] Zoologia del viaggio intorno al globo, &c., Malacologia, 1874, p. 114, Tav. i. fig. 16.

49. *Doriopsis variata*, Abraham.
Chinese Sea (Ning-pô).

50. *Doriopsis parva*, Abraham.
Habitat?

51. *Doriopsis* (?) *punctata* (Rüppell und Leuckart).
Red Sea.

52. *Doriopsis* (?) *aurea* (Quoy et Gaimard).
Pacific Ocean.

53. *Doriopsis* (?) *nodulosa* (Angas).
Pacific Ocean.

54. *Doriopsis* (?) *carneola* (Angas).[1]

Doriopsis nebulosa, Pease (?) (Pl. IV. figs. 5, 6; Pl. V. figs. 28–31).

Doriopsis nebulosa, Bergh, Neue Nacktschnecken der Südsee, III. Journ. d. Mus. Godeffroy, Heft viii., 1875, p. 95, Taf. vii. fig. 5, Taf. xi. fig. 24;—IV., *loc. cit.*, Heft xiv., 1878, pp. 23, 24.

Habitat.—Sandwich Islands (Honoruru).

One specimen was taken on the Reefs of Honoruru; it was preserved in alcohol, and was rather contracted. Its length was about 4 cm., with a breadth of 2·5 cm. and a height of 1·7 cm.; the breadth of the mantle edge was from 1 to 4 mm., behind about 9 mm.; the height of the retracted rhinophoria about 3·5 mm., and of the retracted branchia 5 mm., the diameter of the branchial cleft about 2·75 mm.; the breadth of the foot 1·5 cm., the length of the tail 3·5 mm. The *colour* of the dorsal surface was of a bluish-grey, of the sides of the body yellowish-grey, with an indication of two or three longitudinal bands formed of series of spots; the sole of the foot also was of a yellowish-grey; the branchia and *rhinophoria* bluish-black, the latter with a whitish terminal papilla.

The *form* of the body, as far as could be made out, is longish and stout; the edge of the mantle undulating, and gradually increasing in breadth from before backwards, where it forms a kind of caudal veil; its under surface is smooth. The dorsal surface is everywhere strongly wrinkled, and therefore is everywhere divided into variously-sized

[1] The Family Doriopsidæ contains the remarkable genus *Doriopsilla*, which differs from *Doriopsis* by its stiff body and hard granulated back, and also by the position of the buccal ganglia. But one species, *Doriopsilla areolata*, Bergh, from the Mediterranean, is known; but perhaps *Doriopsis granulosa* of Pease is in reality a *Doriopsilla*. *Cf.* my Doriopsiden des Mittelmeeres, *loc. cit.*, 1880, pp. 316–326.

"islands," with the exception of the caudal veil; here and there are small, whitish, knob-like elevations, not exceeding 1 mm. in diameter. The club of the *rhinophoria* has on either side about thirty leaves and a strongly developed terminal papilla. The branchial *cleft* is transversely oval; the strongly retracted branchia is formed of eight tripinnate branchial leaves; the branchial circle is completed by the anal papilla (about 2·5 mm. high), whose opening is slightly prolonged downwards on the anterior side; at its base, a little to the right, is the *renal aperture*. The *mouth* is a fine pore, on either side of which is an inconspicuous knob-like *tentacle*. The foot is as usual.

The position of the intestines is as usual; the peritoneum is colourless.

The *central nervous system* is enclosed in the usual capsule, which is as usual attached by frenula to the region above and between the salivary glands.[1] The clear whitish-yellow ganglia form a thick ring, the upper half of which in the middle line is about double as long (from before backwards) as the lower half. The arched upper half of the ring appears beneath the lens to be very granular, the granules measuring about ·5 mm; it is broader behind, with a superficial median longitudinal furrow marking the boundary between the two halves; the under surface is smooth; the lateral portions pass into the smaller under half of the ring, which lies forwards; they are separated from it by a slight groove. The cerebral ganglia are long and larger than the pleural, which are situated outside their hinder part. From the *cerebral* ganglia arise the nervi orales; in front is the short-stalked ganglion olfactorium proximale, giving off the long winding nervus olfactorius, which at the base of the rhinophorion swells into a small round ganglion olfactorium distale, which gives off two nerves upwards; on its outer side is the short nervus opticus. The *pleural* ganglia give off the nervi palliales anteriores and the nervus pallialis longus; behind on the right ganglion, close to the pedal ganglion, I found another small ganglion (genitale?). The *pedal* ganglia are about as large as the pleural, they are plano-convex, thicker in front, where they are obliquely sloped; they are united by a short, broad, thin commissure (behind which is a narrower double commissure, composed of the sub-cerebral and pleural *commissures*); the ganglia give off three pedal nerves. The *buccal* ganglia are about as large as the proximal olfactory ganglia, and lie between, and a little in front of, the salivary glands, in contact with each other; at their outer part is a somewhat disconnected portion, which may represent gastro-œsophageal ganglia.[2]

The *eyes* are provided with black pigment and a yellow lens; the optic nerves are a little longer than the eyes, taking their origin from small optic ganglia a little larger than the eyes. The *otocysts* are a trifle larger than the eyes, containing a quantity of otoconia

[1] *Loc. cit.*, 1880, p. 301.

[2] I have also seen a similar appearance in *Doriopsis atropos*, *Doriopsis krebsii*, and *Doriopsis tristis*.

of the usual kind. Neither the leaves of the *rhinophoria* nor the skin contain any hard cells, and there are very few in the *interstitial connective tissue.*

The *buccal tube* is yellowish within; the outer surface being whitish, with fine blackish spots; it is 4 mm. long; the strong retractor muscles have many heads. The strong *buccal cone* ("Schlundkegel") is as long as the buccal tube, and fills it; it is yellowish; the opening at the summit as usual;[1] the interior of the buccal cone is also yellowish, with grey spots; the prolongation of the bulbus pharyngeus as usual only loosely fastened to the walls of the buccal cone. The *ptyaline* gland[2] is about 7 mm. broad, 2 mm. thick, and 4 mm. long; it lies beneath the anterior part of the bulbus pharyngeus, in front of the anterior genital mass; it is whitish in colour, and formed of two halves intimately united, and divided into many lobes by deep furrows. The efferent duct is formed of two chief branches, and is thick and coiled, it runs towards the buccal cone, becoming gradually thinner; when unrolled it measures 12 mm.; it runs as far as the end of the buccal cone. The *bulbus pharyngeus*, including the portion enclosed within the buccal cone, is 2 cm. long by ·5 mm., increasing to 1·3 mm. in thickness; yellowish-white and cylindrical, the lumen is arrow-shaped throughout the whole length. The whitish-yellow *œsophagus* is long, sausage-shaped, with numerous constrictions; it is 2 cm. long with an average diameter of 2·5 mm., which decreases in front to 1 mm., and behind to 1·5 mm.; the walls are thick; the interior has retiform folds. The connective tissue of its sheath is not pigmented. At the junction of the œsophagus and bulbus are the *salivary glands*, 1 mm. long by ·4 mm. in thickness, and faintly yellow coloured. The hinder end of the œsophagus is a little constricted, and then passes into the stomach, which is short, enclosed within the liver with the exception of the anterior end; the *stomach* is connected beneath with the wide cavity of the liver and above with the *intestine.* This latter projects somewhat just before the middle of the length of the liver and to the left, forming at its anterior end a short arch, and running in a groove upon its surface reaches the median line and mounts between the two heads of the retractor branchiæ muscle; its total length is 2·5 cm. and breadth 2–2·5 mm.; its inner wall has longitudinal folds.—The hinder visceral mass (*liver*) is 2·2 cm. long by 1·8 cm. broad and 1·4 cm. high; its somewhat excavated broad facetted anterior end is obliquely truncated from the left towards the right side and downwards and backwards; the hinder end is rounded, with a deep narrow cleft, through which the strong retractor muscle of the branchia passes; this cleft is continued on the under side of the liver into a median superficial furrow. On the surface of the liver in front there are on either side two or three deep perpendicular furrows. The colour of the liver outside as well as inside is greyish. The alimentary tract and cavity of the liver contained a mass of undeterminable animal remains.

[1] *Loc. cit.*, 1880, p. 304, Taf. i. fig. 1.

[2] *Cf.* Bergh, On the Nudibr. Gastr. Moll., I., *loc. cit.*, 1879, p. 143 (87).

The *pericardium* and the *pericardial gill* as usual. The yellow coloured chamber of the heart is 2·75 mm. long. The *blood gland* is greenish-grey coloured, about 7 mm. long by 4 mm. in breadth and ·2 mm. in thickness.—The *renal syrinx* is brownish-grey, melon-shaped of 3·5 mm diameter with strong internal folds. The urinary chamber as usual. The retractor longus branchiæ and the retractor papillæ analis[1] as usual.

The *hermaphrodite gland*, by its yellow colour, contrasting markedly with the grey liver, clothes the anterior end and the anterior half of the upper side of this organ with discrete or coalescent lobes; its structure is as usual; the gonoblasts being well developed.—The biconvex *anterior genital mass* about 6 mm. long by 10 mm. broad and 8 mm. in height; the efferent duct projects, moreover, 1·5 mm. The *ampulla* of the hermaphrodite duct (Pl. V. fig. 28, *a*) rests on the upper margin of the genital mass, and is yellow and pear-shaped, 5·5 mm. long (fig. 28, *b*). The male branch, which arises from the ampulla, runs on the upper margin of the brownish-yellow albuminiparous gland (fig. 28, *dd*), and is continued in the whitish-yellowish coloured *prostate* which descends on the anterior end of the genital mass; its total length is 13 mm. and its diameter 1 mm., it is cylindrical or slightly flattened, the upper surface not quite even, the walls thick, the axial cavity therefore rather narrow. From the lower end of the prostate the thin *seminal duct* takes its course to the genital papilla (fig. 28, *e*), in the last portion (·75 mm.) it is a trifle wider, and forms the penis (præputium) (fig. 28, *f*); the whole length of the seminal duct is 8 mm. At the base of the cavity of the yellow præputium is the truncated cylindrical glans, which is about ·25 mm. in length by ·08 mm. in breadth and ·03 mm. at its point. The glans (Pl. IV. figs. 5, 6) has 8–12–15 quincuncially arranged longitudinal rows of fine yellowish hooks, ·013 mm. high (Pl. V. figs. 30, 31); this part of the glans, where the hooks are developed, is not continued backward into the seminal duct proper (Pl. IV. fig. 5, *a*). The *spermatheca* is spherical, about 3·5 mm. in diameter (fig. 28, *g*), whitish in colour; its short duct bifurcates. The vaginal duct (fig. 28, *h*) is thin and quite as long as the vas deferens, behind it becomes a little wider and forms the *vagina* (fig. 28, *i*), whose length is about ·75 mm.; for about ·37 mm. of its length the vagina is lined by a fine brownish cuticle; this portion is about ·013 mm. in diameter, widening like a funnel behind and before (fig. 29, *aa*).[2] The uterine duct (fig. 28, *k*) is rather shorter, coiled, resting on the albuminiparous gland, and opens close to the female branch of the ampulla (fig. 28, *c*); just in front of its opening it receives the short duct of the spherical *spermatocyst* (fig. 28, *l*); this organ is whitish in colour and has a diameter of 2 mm.; it was filled with semen. The *mucous gland* is large, white and yellowish-white in colour; the albuminiparous gland is free at the upper margin and on the hinder

[1] *Loc. cit.*, 1880, p. 307.

[2] I have observed a similar condition in *Doriopsis tristis* (*op. cit.* III. *Journ. d. Mus. Godeffroy*, Heft viii., 1875. Taf. xi. fig. 5;—IV. Heft xiv., 1878, Taf. ii. fig. 17), and also in *Doriopsis debilis* (Malacolog. Untersuch., *loc cit.* Supplementheft i., 1880, p. 11, Taf. D. fig. 29).

side of the mucous gland, its colour is brownish-yellowish; the cavity was empty. On the upper side of its duct is the strong crescent-shaped white *vestibulo-vaginal gland*, 2·5 mm. in length and 1·3 mm. in height.

Whether this species is identical with *Doriopsis nebulosa*, previously described by me, or not, must be for the present left undecided; in external appearance at any rate it is very like *Doriopsis nebulosa*.

APPENDIX.

Family Onchidiadæ.

Pulmonata (non testacea) doridiformia; limbo palliali plus minusve prominenti, recto vel undulato. Dorsum papillis vel tuberculis simplicibus vel compositis, interdum frutescentibus, ut plurimum pro parte ocelligeris obtectum; clypeus frontalis (subpallialis) fortis angulis tentaculiformibus, et postice rhinophoriis (ophthalmophoriis) exsertilibus cylindricis, juxta apicem ocelligeris. Pneumostoma posticum medianum vel submedianum infrapalliale; infra pneumostoma anus. Secundum totam longitudinem lateris (humilis) dextri corporis sulcus genitalis (fœmininus), juxta porum glandulæ pediaeæ medianum, supra podarium antice situm, desinens; in parte postrema sulci vulva. Apertura genitalis masculina in facie superiore clypei frontalis submediana vel fere infra rhinophorium dextrum sita. Podarium latum.

Bulbus pharyngeus fere semper sine mandibula. Ventriculus compositus.

Vas deferens pro parte latere corporis inclusum, sulco genitali contiguum, deinde liberum, longissimum, ut plurimum ultima parte seriebus uncinorum armatum. Glandula cum ampulla et hasta amatoria ut plurimum non desunt.

The Onchidiadæ are specially modified shell-less Pulmonates, and resemble somewhat the Doridide in outward form, and therefore were included in the Nudibranchiata by de Blainville. They resemble also the typical *Doris* in having a thick straight or sinuate *mantle-brim*. The *dorsal surface* is uneven, more or less densely covered with papillæ and tubercles, which are simple or compound; sometimes, especially in the hinder part of the body, they are frutescent (*Peronia*); these papillæ very usually bear groups of eyes, which have the structure of vertebrate eyes.[1] In front, below the mantle edge and above the mouth, is a strong, roof-like *frontal shield;* at the base of this and above

[1] Semper, Reisen im Archip. d. Philipp., Th. II. Bd. iii., Landmollusken, Ergänzungsheft, Ueber Sehorgane vom Typus der Wirbelthieraugen. m. 5 Taf., 1877.

on either side is the strong cylindrical *rhinophore* (ophthalmophore), which is exsertile, and bears an eye on its outer end; at the sides the frontal shield is prolonged into a tentacle. In the middle line, at the hinder end of the body, on the under surface of the mantle edge, generally at its base, is the *pneumostome*, the lung-aperture; below this, and above or at the root of the short tail is the *anus*. Along the right side of the body runs the *female genital furrow*, which is ciliated during the life of the creature; it commences in front of the anus, and is prolonged as far as the region of the opening of the so-called *foot gland*, which lies in the median line, above the anterior margin of the foot. At the hindermost extremity of this furrow lies the *female genital opening*; the *male* aperture is at the upper side of the frontal shield, nearer the middle line or below the right rhinophore. The *foot* is large and generally broad.

The *central nervous system* resembles that of other Pulmonates, as do the sense-organs; the remarkable dorsal visual organs, proper to this group, are formed on the type of the vertebrate eye.—The bulbus pharyngeus and tongue are like those of other Pulmonates; jaw-like organs are found only exceptionally (*Onchidium boreale*). There are three stomachs—an anterior, a masticatory, and a posterior (a kind of psalterium). The *liver* is also divided into three portions—an anterior (-upper), an inferior, and a posterior (-upper). The *intestine* is very long. The *lung cavity* is at the hinder end of the body, and extends to the right upwards; it opens nearly always in the median line, through the short respiratory tube with its aperture (pneumostome). On the walls of the lung cavity is the renal organ, which appears to open within it close to the respiratory tube.[1] The pericardium lies in the body-wall.—The hermaphrodite gland is made up of two halves, and is of the usual structure. The hermaphrodite duct forms only a very small or no special ampulla. The anterior genital mass (mucous and albuminiparous glands) is short and more or less rounded. The vesicula seminalis is large, roundish, and opens at the base of the duct of the mucous gland; this last duct opens within or at the hinder end of the female genital furrow. The vas deferens first takes its way along the mucous duct, and with it enters the side wall of the body, and then bends forward and becomes much thinner, and is enclosed within the body wall,[2]

[1] V. Jhering has, as is well known, divided the order Pulmonata (Vergl. Anat. d. Nervensyst. d. Moll., 1877, pp. 225–239, and Ueberdie system. Stell. von Peroniau. die Ordn. Nephropneusta, Jh., 1877) of Cuvier into two orders—the Nephropneusta (*Helicoidea*) and Branchiopneusta (*Limnoidea*). He agrees with Milne-Edwards (Leç. s. la phys. et l'anat. comp. t. ii., 1857, p. 91) in regarding the lung of the first-mentioned as morphologically the dilated termination of the renal organ (or cloaca) of the marine Ichnopoda; and the lung of the second group as the equivalent of a branchial cavity, from which the branchiæ have disappeared. Semper (Einige Bemerk. üb. die Nephropneusten v. Jhering's. *Arb. aus dem zool. zoot. Inst. in Würzb.*, Bd. iii., 1877, pp. 480–488) has brought forward considerable evidence against this, which has hardly been weakened by a later work of v. Jehring's (Ueber die system. Stellung von Peronia und die Nephropneusta, 1877, pp. 30–32).

[2] Other Pulmonata show the same course of the vas deferens. In *Veronicella* (*Vaginulus*) the condition is similar, but the part imbedded in the musculature is shorter, because the place where the vas deferens is imbedded in the skin lies, together with the vulva, about the middle of the side, and not at its end, as in *Onchidium*. A similar condition is also found in the Auriculacea and Lymnæacea, in which also a portion of the vas deferens, but much shorter than in *Onchidium*, is imbedded in the body-wall. *Cf.* Semper, *loc. cit.*, p. 251.

running along the genital furrow in its immediate neighbourhood towards the frontal shield, within which it forms an arch, and leaving it in the region below the right rhinophore, enters the body cavity; now this long free portion of the duct is somewhat thicker, and forms a coil in which the two parts, the prostatic and muscular, can often be easily recognised by their colour. To the last part of the vas deferens is attached a strong retractor muscle, and the vas deferens is then continued into the longer or shorter (when retracted) sac-shaped penis, which opens into the male genital cleft.[1] In most Onchidiadæ the last part of the vas deferens is lined with a strong cuticle, which, as in the Doriopsidæ, Phyllidiadæ, and other Nudibranchiata, has longitudinal rows of small hooks; the anterior portion of this last part can be everted. In many Onchidiadæ[2] there opens near the penis a very long coiled glandula hastatoria, which is prolonged in front into a spindle-shaped or sausage-formed ampulla, opening on to the male genital cleft at the side of the penis by its special duct and the straight long dart at its end.

Concerning the *development* of *Onchidium* not much was known until recently. Stoliczka observed that the young animals live massed together in deep earth-holes, and remarked that they perhaps had a direct development without larva. Semper[3] endeavoured, but in vain, to find the eggs. Joyeux Laffuie[4] finally succeeded in tracing the development of *Onchidium celticum*.

Onchidium appears to be *amphibious*, inasmuch as it is found on those parts of the shore where there is a regular ebb and flow.[5] According to Semper[6] the *function of the dorsal eyes* is to protect the animal from its (presumed) chief enemy, *Periophthalmus;* immediately it sees one of these approaching, it draws its body together and squeezes out a secretion from abundant cutaneous glands.

Onchidium is mainly an inhabitant of tropical or sub-tropical regions; from the Mediterranean only one species (*Onchidium parthenopeium*, d'Ch.) is known, and a very similar (*Onchidium celticum*, Cuv.; *Onchidium boreale*, Dall) from the northern part of the Atlantic. The different "species" agree very much in the outer form, and most of the species described by different authors will not be recognised with certainty. In recent times Semper has observed that certain parts of the genital apparatus afford useful systematic characters. The division of the Family into the genera *Onchidium*, *Peronia* (Blainville), and *Onchidella* (Gray) cannot be retained. Stoliczka[7] first clearly showed this. Semper[8] divides the Onchidiadæ into *Onchidium* proper and *Onchidella*

[1] Semper, *loc. cit.*, p. 254. [2] Semper, *loc. cit.*, p. 254. [3] Semper, *loc. cit.*, p. 488.

[4] Joyeux Laffuie, Organisation et développement de le l'Oncidie, *Oncidium celticum*, Cuv., *Archives de Zool. expér.*, t. x., 1882, pp. 1–159, pls. xiv.–xxii.

[5] Jhering, Ueber die system. Stell. von Peronia, 1877, pp. 9–15.—Joyeux Laffuie, *loc. cit.*, p. 237.

[6] *Loc. cit.*, pp. 30–32.

[7] Stoliczka, The Malacology of Lower Bengal, I., On the genus Onchidium, *Journ. of Asiat. Soc.*, vol. xxxviii. 2, 1869, pp. 100, 101.

[8] Semper, *loc. cit.*, Ergänzungsh., 1877, p. 40; Heft v., 1880, p. 254.

(which is not co-extensive with Gray's *Onchidella*); whether this generic distinction can really be made must be left doubtful for the present.

The Onchidiadæ unite the characters of the Steganobranchiata, the Nudibranchiata, and the Stylommatophorous Pulmonata. They are, like the first two groups, generally marine. In having a ciliated furrow on the right side, they resemble the Steganobranchiata. In the general form of the body they are not unlike *Doris*. The central nervous system closely resembles that of the Pulmonata; still, the pedal ganglia are separated, as in the Nudibranchs; and the retractors of the rhinophoria also resemble those of this latter group. They are, however, more especially *related to the Stylommatophorous Pulmonata*, like them possessing rhinophoria (Ophthalmophoria) and a foot gland. In spite of its modification, the nervous system is fundamentally similar, the gastro-œsophageal ganglia being also absent. They have also the uropulmonary system of the Pulmonata, and resemble them further in the structure of the genital system; a *spermatocyst* is *always absent*. The *blood gland*, so commonly present in the Doridida, is also *absent*.

With regard to the phylogenetic development of the Onchidiadæ, it seems likely that they have really nothing to do with the Nudibranchiata. A number of intermediate forms, however, connect them with the Pulmonata, and it seems more reasonable to suppose that they *descend from the Stylommatophorous Pulmonata* (Nephropneusta, v. Jhering), with which group they agree so closely in anatomical structure, and from which they do not deviate too much in development. They seem, in short, to be Pulmonata which have become adapted to an amphibious or marine life.[1]

Onchidium, Buchanan.

Onchidium melanopneumon, n. sp. (Pl. IV. figs. 25–27; Pl. V. figs. 1–27; Pl. VI. figs. 5–18, 20, 21).

Species *Onchidio tongano* magnopere affinis, colore dorsi obscuro (atro vel cæruleo-atro ?), pulmone aterrimo.

Habitat.—Pacific (Fiji Islands).

Only one specimen was taken in shallow water at Kandavu, in the Fiji Islands, August 1874, and was preserved in alcohol. The length of the animal was 6·5 cm., its breadth 4 cm., and its height 2·5 cm.; the breadth of the mantle edge about 1 cm., of the foot about 2·1 cm.; the free anterior margin of the foot projects about 4 mm., the tail is 6 mm. long, the head 17 mm. broad, the length of the rhinophoria 5 mm., the diam. of the pneumostome-papilla 5·5 mm.

[1] Brock, in his critical review of the memoir of J. Joyeux Laffuie (Biolog. Centralblatt., Bd. iii., 12, 1883, p. 370–374), regards the Onchidia as Nudibranchiata, allied to them by their organisation as well as by ontogeny. The Memoir of Dr. Brock did not come to hand before this sheet had been printed, but I still regard his opinion as erroneous.

The *colour* of the dorsal surface is bluish-black, the upper side of the head rather more brightly coloured; the upper surface of the rhinophore also of the same colour on account of the muscle shining through it, yellowish beneath. The whole under surface of the mantle edge and head, the sides of the body, and the foot also, are yellowish.

The *shape* of the body is as usual. The dorsal surface is covered with a number of rounded greyish simple or granulated tubercles (Pl. IV. fig. 25; Pl. V. fig. 2), measuring about 3·5 mm. in diameter, and 1–1·5 mm. high; among them are a number of smaller tubercles; towards the margin of the back these tubercles become smaller. The *eyes* were hardly distinguishable by a lens; in transverse sections of the skin they appeared to be scattered about singly or united in groups of three or four round a central papilla. The thick mantle edge is somewhat thinner, and sinuous in outline at the extreme edge; beneath it is smooth. The *frontal shield* (Pl. V. fig. 1) is strong and crescentic, somewhat crenate in the middle line, with rounded tentacular edges, at the base of which, above and laterally, are situated the nearly cylindrical rhinophoria (fig. 1), which bear at their summits the eyes, which were, however, invisible, the rhinophoria being not quite protruded. In front of the right tentacle at the upper side of the shield is the short slit-shaped *orifice of the penis*, about 2 mm. wide; at the base of the lower side the perpendicular mouth-slit with thick folded lips (fig. 1). At the hinder end of the body, at the under side of the mantle edge, is the *lung aperture* (pneumostome), even in its contracted state measuring about 1 mm. in internal diameter, surrounded by thick lips (Pl. V. fig. 2). On its inner side, at the base of the tail, is the *anal aperture*, the transverse diameter of which is 2·5 mm. (fig. 2). Near this last, on the right side, is a little papilla bearing the female *generative opening* (fig. 2). The papilla is continued into a long groove with two folds; this *genital groove* is prolonged along the low right side as far as the frontal shield, and is bent inwards at the root of the tentacle, and can be followed as far as the fine *pore of the foot gland* (situated behind the mouth), which lies deep in the space between the head and foot (Pl. VII. fig. 1, *b*). The *foot* is strong and broadest in the middle; the anterior portion is separated from the head by a space of about 4 mm.; it has a superficial marginal furrow (Pl. VII. fig. 1, *a*); the upper lip is slightly cleft in the middle line; the tail (Pl. V. fig. 2) is short and flattened, somewhat pointed, rounded at the end; the margins slightly (about 2 mm.) projecting.

The walls of the body, on the back as well as the foot, are (as much as 5 mm.) thick and leathery. The pseudo-peritoneum is quite colourless, the dissepiment behind the salivary glands only being slightly grey.

When the animal was opened, the organs of the body were seen to have the following relations to each other (Pl. V. fig. 27). At the anterior extremity is the mouth-tube (fig. 27, *a*) and the bulbus pharyngeus (*b*), then comes the œsophagus (*d*), directed obliquely backwards to the left, and on each side of it the yellowish-white salivary glands (*c*, *c*); after this comes the large dark greenish-grey anterior liver (*f*), bounded by

a loop of the intestine and traversed by the continuation of its right hand portion (*ee*); along the intestine on the left side is the sac-like ampulla of the glandula hastatoria (*h*). Behind the loop of the intestine and the anterior liver, is the dirty yellow-coloured masticatory stomach, of which the larger part of the left half is visible, with a whitish tendinous patch, and behind this the large dark greenish-grey hinder liver (*g*); on the right side of the liver and stomach lies the large whitish pericardium (*k*), fused with the wall of the body; on its inner side and covered by it is the large anterior genital mass (fig. 26, *b*), extending as far as the right hinder portion of the liver, and lapping the yellowish-white hermaphrodite gland, which fills (fig. 26, *a*) the hinder end of the body cavity. The hindermost end of the body is taken up by the black lung (fig. 27, *i*). Below the right salivary gland are visible the winding coils of the vas deferens, and further forward another portion of the same with the penis. Along the left side in a space are seen the coiled windings of the glandula hastatoria as a prolongation of its ampulla.—On the underside the situation of the viscera was as follows. Quite in front were the buccal tube and bulbus, then on the right the lower portion of the left salivary gland, and on its inner side the lower portion of the central nervous system; then follows on the right the ampulla of the glandula hastatoria and its coiled prolongation; on the inside of and behind this the radially striated third stomach; on the left side of which, and behind, is the under portion of the anterior liver. Further back, along its right margin, lies the hinder liver; on the inside of this, in front, is the transversely-placed anterior genital mass, behind which on the right, is the dirty-yellow vesicula seminalis, and on the left the yellowish hermaphrodite gland. The hinder end of the body finally is taken up by the black lung.

The central nervous system, which elsewhere in the genus *Onchidium* generally lies uncovered upon the upper side of the bulbus pharyngeus and the salivary glands, was in this specimen retracted, and surrounded the hinder part of the œsophagus, and was therefore (Pl. V. fig. 27) quite covered by the anterior liver. It did not quite agree with v. Jhering's[1] description of *Onchidium verruculatum*, Cuvier. It lay within a loose, but still adherent connective tissue capsule, which was prolonged some way along the roots of the nerves, and which could be only with difficulty separated from the ganglia. The ganglia themselves showed a greyish-brown colour. The central nervous system was, as usual, constructed of an upper and lower portion, both of which were considerably flattened. The *upper* portions—the *cerebral ganglia*—were of a rounded contour, and united by a strong commissure, about as broad as the diameter of the ganglion; each ganglion gave off the following nerves: the strong nervus tentacularis supplying the tentacle, and giving off the delicate nervus opticus; the nervus velaris, which divided into two branches; at least two nervi orales, two labiales, and several nervi bulbi pharyngei; finally a nervus genitalis externus to the penis, and the cerebro-buccal

[1] H. v. Jhering, Vergl. Anat. d. Nervensyst. d. Moll., 1877, pp. 230–232, Taf. iv. fig. 16.

connective.[1] The *lower* half was connected with the upper on either side by two connectives; it consisted of two pairs of ganglia lying upon each other, whose wide, broad commissure was about as long as the greatest diameter of the ganglia; they were separated by the strong arteria bulbi pharyngei. The (three?) *pleural ganglia* were somewhat smaller than the others, less flattened, and of transversely oval form; in front of their commissure was the thin sub-cerebral commissure. From each ganglion four nerves, partly united at the base, were given off to supply the side walls of the body and the back; one of these was especially thick, and extended backwards along the sides of the back. From each ganglion were given off two nerves, running along the sides of the posterior aorta as far as the anterior genital mass, giving off to it several branches, and finally reaching the hermaphrodite gland; from one of the left nerves a strong branch went to the region of the anterior bile duct. From the right side of the visceral commissure, near the ganglion, two nervi genitales arose, and were distributed to the vas deferens and the glandula hastatoria. The *pedal ganglia*, rather larger than the others, were of a rounded contour; they gave off a short nervus pediaeus anterior, a nervus pediaeus medius externus, and a nervus pediaeus posterior longus, which entered the sole of the foot about the middle of its length, dividing into a superficial and deep branch; from the latter arose numerous twigs directed obliquely inwards. A rope-ladder-like system, as first described by Semper[2] in opposition to v. Jhering[3] cannot, however, be dissected *in situ*. The *buccal ganglia* are of a rounded contour, and lie within a wide, but still rather adherent capsule united by a commissure (Pl. V. fig. 3, *b*), about double as long as the diameter of the ganglia; the two nerves going off from them supply the salivary glands, the œsophagus, and the hinder portion of the bulbus; upon them were ganglionic swellings; from the middle of the commissure a strong dichotomously branching nerve was given off, running backwards. *Sympathetic ganglia*[4] were found here and there upon the viscera; on the spot, where the arteria genitalis divides on the under surface of the anterior genital mass, there was a large white ganglion of oval contour and ·3 mm. diameter.[5]

The summit of the *rhinophore* was invaginated about 1·2 mm., and at the bottom of this depression was the *eye;* its greatest diameter was about ·28 mm.; the lens was yellowish, the pigment blackish-brown. The fine optic nerve was given off as a branch from the upper part of the rhinophorial nerve. At the base of the eye, enveloping it,

[1] It would be of high interest to examine whether the *Onchidia* possess the mouth-lobe-ganglion of the Pulmonata.

[2] *Loc. cit.*, p. 481.

[3] H. v. Jhering, Ueber die system. Stell. von Peronia, 1877, pp. 8, 9.

[4] According to Semper, *the buccal commissure* with its ganglia in the Gasteropoda represents the vagus of the Annelides. *Cf.* P. B. Sarasin, Entwicklungsgesch. d. Bithynia tentaculata, 1882, pp. 56, 57.

[5] Owing to the state of hardening of the central nervous system, it was impossible to investigate it fully. There appeared to be three pleural ganglia, of which the smaller right one and the median one were more nearly approximate.

is inserted the strong black-pigmented retractor magnus muscle ; the other thinner retractors were similarly pigmented in the upper part. The rhinophorial nerve swells above into a small *rhinophorial ganglion*, which gives off several nerves, forming a network of branching fibrils, the *plexus gangliosus*, the ultimate fibrils of which end in the *olfactory epithelium* at the end of the rhinophore. The walls of the cavity of the rhinophoria were provided with some special thin nerves. I did not succeed in finding the *otocysts*,[1] owing to the strong pigmentation of the central nervous system. The *skin* (of the back) has an outer cuticle, underlying which is a thin single layer of cylindrical epithelial cells, among which were a number of variously-sized unicellular glands, with clear or granular contents. The peculiar dorsal eyes were present.[2]

The *buccal tube* (Pl. V. fig. 3) is strong, 6·5 mm. long, with a diameter at its hinder end of 8 mm.; in the middle line above are attached two lateral retractor muscles (figs. 3, 27), and just in front of them, running forwards, are a pair of protractors ; on the underside two stronger retractors (fig. 3, *c*); the interior of the buccal tube has the usual longitudinal folds. —The strong *bulbus pharyngeus* (Pl. IV. fig. 26 ; Pl. V. fig. 3) is about 10 mm. long by 9·75 mm. in breadth and height ; the strong radula-sheath also (Pl. IV. fig. 26, *a*; Pl. V. fig. 3, *d*) projects backwards about 3·5 mm.; the underside of the bulbus is flattened, the sides rounded, the upper side sloping at a considerable angle, both in front and behind; in front, on the under side, are a considerable number of protractor muscles. On opening the bulbus there were seen, on either side above the root of the tongue, a longish *palatal plate*, rounded at one end and more drawn out at the other (fig. 4, *b*, *b*), of a pale chitinous-yellow colour, and about 3 mm. in length by about 1·4 mm. in breadth. A closer examination showed these plates to be made up of a number of irregular borders and raised portions, generally prolonged into more or less worn-out teeth (figs. 5, 6); this whole chitinous layer was about ·2 mm. high. In the longitudinal and transverse furrows, also between these palatal plates here and there, instead of the ordinary cuticle, special similar thickenings were found (fig. 5). The fine terminal end of the palatal plates was continued as far as the opening of the pharynx (fig. 4). The *tongue* (Pl. V. fig. 4, *a*) was as usual, broad and strong, with a deep dorsal furrow; on the chitinous yellow radula there were forty-eight *rows of teeth* (counting by the outer edge of the radula), of which twenty-three were more or less incomplete, with a good many teeth worn; on the point of the tongue there were traces of two series that had dropped away. Further back, within the radula-sheath, there were forty-one developed and four not fully developed series; the total number was thus ninety-three. The total length of the

[1] In a small specimen of *Onchidium palaense*, S., measuring about 2·5 cm., from the Philippine Sea, I discovered the otocysts, visible as white points beneath the lens, in front of and above the pedal ganglia; their diameter was about ·12 mm., and they contained a large number of round and oval otoconia, measuring about ·007 mm. in diameter.

[2] Semper found among all the species of *Onchidium* which he investigated, only two, *Onchidium steindachneri* and *Onchidium reticulatum*, that did not possess dorsal eyes.

radula (separated from the tongue and the sheath) was 16·5 mm. by about 12 mm. in breadth. On the thirty-eighth row of the tongue there were 117 teeth on each side; on one of the youngest (the seventy-ninth) there were only 118. The *teeth* showed a clear yellow colour, generally darker on the thicker parts. The breadth of the median teeth (behind, on the tongue) was about ·07 mm., their length ·09–·11 mm.; the length of the hook of the innermost lateral tooth (behind, on the tongue) was about ·09 by ·08 in height, that of the six succeeding teeth ·16, ·18, ·2, ·22, ·235, ·25, and the length increasing to ·27 mm.; the height of the teeth from the sixth was ·18 mm. The length of the hook of the outermost tooth was about ·06 by ·044 mm. in height; the following ones ·068 mm. in length (by ·06 in height), ·08, ·1, ·1, ·11 mm. (by ·08 mm. in height), ·12, ·13, ·14 mm. (by ·01 mm. in height) and ·16 mm. The length of the cuticular thickening on the outside of the outermost plate was about ·025–·03 mm. The median teeth (Pl. IV. fig. 27, *a*; Pl. VI. fig. 5, *a*) are flattened and truncated at both ends, broader behind than in front; the anterior half thicker than the posterior, obliquely inclined in front, highest in the middle, forming a strong pointed hook, as also a denticle upon the lateral portions, which are directed obliquely inwards. The first *lateral tooth* (Pl. IV. fig. 27, *b*,*b*; Pl. V. figs. 7, *a*, 12, 13) is strong and clumsy, with a shorter base, which bears on the outer side a strong denticle; the hook much smaller than in the succeeding teeth. In the next following teeth (Pl. V. figs. 7, *b*, 8, 9, *a*, 10; Pl. VI. fig. 5) the base, but especially the hook, becomes gradually longer; in all the succeeding teeth (Pl. V. figs. 14, 16), which are the most numerous, they retain the same size, and in the outermost portion of the row—about the outer sixth—they again decrease (fig. 15). The body of the teeth (figs. 8–11) is strong and compressed; the longish basal part (fig. 16) is a trifle broader in front; in front and above on the outside of the body, close to the beginning of the hook, is a strong, obliquely flattened, pointed denticle (figs. 7, 8, 9, 10, 14); the inner side of the body is smooth (fig. 11). The hook is directed obliquely outwards and gradually bent (figs. 9, 10), its edges are smooth, and the end is more or less obliquely rounded off; the upper side is obliquely flattened, the under keel-shaped with a furrow along each margin (figs. 8, 10). The outermost tooth (figs. 14, *a*, 15, *a*, 19, *a*) is quite small with a short hook, but with a strong denticle on the outer side of the body. On the outer side of this last tooth I nearly always found one (fig. 14, *a*) or two (fig. 17, *a*) thickenings of the cuticle, thin, yellowish, and elongated.[1]

The *salivary glands* are pale yellowish-white, rounded, triangular masses, lying on the sides of the œsophagus (Pl. V. fig. 27, *c*,*c*), filling up the space between the bulbus pharyngeus and the anterior liver mass; the left gland is about 12 mm. long by 5·5 mm. in breadth, and of the same thickness; the right gland is smaller and broader, 8 mm. long, 13 mm. in breadth, and 5 mm. in thickness. In transverse sections their form is triangular; the outer surface (fig. 27) is convex and smooth, but divided into lobules by

[1] Hitherto there have been no accurate investigations into the mouth-organ of *Onchidium*.

small furrows; the inner and upper surface is smaller and fastened to the œsophagus; the inner, lower surface is large, and attached to the large ampulla of the glandula hastatoria. The salivary ducts (fig. 27) are rather short (3 mm. long) and open into the pharynx.

The *œsophagus* is strong and rather wide (Pl. V. fig. 27, *d*; Pl. VI. fig. 6, *b*), and passes obliquely to the left and then downwards; when fully extended it measures 3·5 cm., with a diameter of 4·5 mm. in the anterior part, and 1·5 mm. in the posterior; the interior has numerous folds, which are prolonged into the upper part of the stomach. The *first stomach* (Pl. VI. figs. 6, *e*, 7, *e*) is short and pear-shaped, about 11 mm. long by 9·5 mm. in diameter; it is yellowish in colour, with a thin wall not more than ·4 mm. thick, but with stronger circular bundles; the inside is covered with fine longitudinal folds, which usually bear very fine tubercles; the opening into the œsophagus and into the anterior (fig. 6, *c*) and inferior (fig. 6, *d*) hepatic duct, is round, with fine folds. The *second stomach* (figs. 6, *f*, 7, *f*; Pl. V. fig. 27) lies obliquely from above downwards and to the right; it is 15·5 mm. broad and about 7·5 mm. long in the middle, and at the ends 9 mm., with a thickness of 9 mm.; this masticatory stomach is somewhat compressed above, rounded and flattened, the lower end also rounded, the hinder end deeply cleft (Pl. VI. fig. 6); the median and largest portion of both flattened sides is occupied by a large tendinous patch, almost hour-glass shaped, of the ordinary bluish-white nacreous appearance; this stomach is marked off from the first stomach by a circular furrow, deeper above; a tendinous cord, broader at its two extremities, joins (fig. 6) the upper end of the second stomach with the third stomach. At the middle of the sides of the organ, where the tendinous patch is, the thickness of the wall is ·5 mm., at the ends they are (fig. 8) 6–6·5 mm. thick; in front the cavity of the masticatory stomach is connected with the first stomach by a wide oval aperture, the margin of which projects slightly into the interior of that first stomach; behind and above there is a small recess (fig. 8, *b*), which is prolonged and opens by a wide aperture into the posterior bile duct. The inside of the masticatory stomach behind (fig. 8, *b*) and in front (fig. 8, *a*) has longitudinal folds, but is smooth in the middle portion, on account of the thicker, somewhat uneven, yellowish cuticle. This cuticle was traversed by longitudinal furrows, and here and there by transverse furrows, which, by their intersection, mark off small longish, slightly-raised tubercles (Pl. V. fig. 23). When these thickened portions were cut through perpendicularly, the wall beneath this (·4 mm. thick) cuticula (Pl. VI. figs. 8, 9) and the epithelium attached to it, was seen to be composed of alternate layers of longitudinal and perpendicular muscle-fibres, which were easily separated from each other. On longitudinal section (fig. 8) they showed about six longitudinal bands, whitish, with a tendinous glitter,[1] which, however, do not reach from one end to the other; these longitudinal bands are composed of a number of longitudinally running fibres; they are separated from each other by short, perpendicular fibres of greyish-yellow colour. On trans-

[1] The above-mentioned small species (*Onchidium palaense*, S.) had a similar structure, and about the same number of bands (6).

verse section these last (fig. 9) appeared as yellowish-white longitudinally striated lamellæ, which at either end unite into a common muscular mass; between these lie greyish-white perpendicularly striated lamellæ, the same which in longitudinal section are tendinous-glittering white. The white hue of these lamellæ is the optical expression of sections which follow the direction of the lamellæ. The wall of the stomach consists in this way of layers of muscular fibres, which are made up of thin strands lying in close proximity; the layers alternate in direction, and are, therefore, quite different in longitudinal and transverse section. In the periphery of the organ the layers unite into a very thick, tight covering, which contains abundant blood-vessels (fig. 8). To the right hand and above in the first stomach (which may be regarded as an antechamber to the masticatory stomach) is the wide obliquely-oval orifice of the third stomach, the lamellæ of which are very conspicuous in the depth of the orifice; the hinder margin of the opening is more conspicuous, and projects in the form of a fold with transverse furrows. The *third*, the lamellated *stomach* (fig. 6, *h*) is united by a short neck with the first stomach; it is of a rounded angular contour, somewhat flattened, of about 11 mm. diameter by about 6 mm. in height; it is radially striped with a blackish colour, the folds of the inside are visible from the outside, especially at the margins. Besides the above-mentioned ligaments between this and the second stomach, there are also two strong bands on the upper surface, the exact relations of which could not be made out. The walls of the third stomach are not thick; the inside has numerous yellowish-white variously-sized folds passing from above downwards, which at the lower end reach a height of quite 3 mm. Generally a high fold alternates with several quite low ones; the largest folds are provided at the sides with smaller longitudinal folds directed upwards (Pl. V. figs. 21, 22). All the folds converge after the middle point of the stomach, and leave a fine central space. Below the folds are much lower in the opening of the stomach; above they gradually decrease in size as far as the intestine, where they end rather abruptly. The *intestine* (Pl. VI. fig. 6, *ik*) takes its rise at the upper end of the third stomach, and runs forwards for a short space (12 mm.), and then bends to the right, and ascending along the right side of the body, traverses a more or less superficial furrow upon the liver (Pl. V. fig. 27, *ee*), winding forwards and backwards; in the region of the middle of the pericardium it descends, bending backwards, and runs beneath the pericardium along the under side of the mucous gland, and approaching the middle of the body it takes its course between the foot and the lung-sac to the anal papilla (Pl. V. fig. 2). The length of the whole intestine is 14 cm. with an average breadth of 1·5–2·5 mm.; only the first extent of 6 mm. was somewhat broader, about 3·5 mm. in diameter, *widened into an ampulla*[1] (Pl. VI. fig. 6, *i*), showing on its outside a number of black pigmented lines. The inside of the intestine is yellowish-white in colour, and furnished throughout its entire length with fine longitudinal folds, which are a trifle higher in the ampulla, and

[1] This ampulla is regarded by Cuvier as a special stomach (Mém. sur l'Onchidie, p. 8, pl. figs. 5*y*, 7*y*).

separated by a smooth, narrow space from the stomach folds; these folds could be traced as far as the anal papilla (Pl. V. fig. 2).—The *alimentary canal* contained a quantity of whitish, rather hard matter, which was less abundant in the œsophagus and intestine; it consisted of calcareous matter and numerous littoral Algæ,[1] among which were species of *Calothrix* and *Percursaria* (*Enteromorpha*) *percursa*, Ag., mixed with the débris of a species of *Cladophora*.[2]

Of the three divisions of the *liver*, which were all of a dark greenish-grey colour, the *anterior* (Pl. V. fig. 27, *f*) was 16·5 mm. broad by 9 mm. in breadth and 10 mm. in height; its shape was concavo-convex, and it was traversed on its upper surface from the right margin by three deep furrows, reaching almost to the middle, and dividing it into four portions; further it was divided into lobes by numerous smaller superficial furrows; the intestine occupied a furrow on its upper surface; the anterior liver opens into the first stomach (Pl. VI. figs. 6, *c*, 7, *c*), to the left of and above the cardia. The *lower* and smallest liver mass, lying beneath the anterior stomach (Pl. VI. fig. 7, *d*), was only 13·5 mm. in length, by 14 mm. in breadth and 4·5 mm. in height; it is somewhat flattened in form, and traversed by superficial furrows, and opens by a short bile duct below the cardia into the anterior stomach (fig. 6, *d*). Finally the *hindermost* and largest liver, divided from the anterior by the masticatory stomach, has a length of 22 mm., a breadth of 15 mm., and a height of 8 mm. (Pl. V. fig. 27, *g*; Pl. VI. fig. 7, *g*); from the left margin two furrows run into the middle, and so divide the liver into three lobes; it opens into the recess behind the masticatory stomach (Pl. VI. figs. 6, *g*, 8, *b*). The *bile ducts* are short but wide; the undermost is the shortest (fig. 6, *d*); the hindermost is the longest (fig. 6, *g*, 8, *bc*), and is divided into three or four branches, which are again subdivided, and can be followed into the smallest lobes. On the main bile ducts were here and there smaller and larger liver lobes (Pl. VI. fig. 10); the walls of the chief bile ducts are strong and muscular, the inside provided with longitudinal folds with a thick epithelium.

The inner wall of the *pericardium* (Pl. V. fig. 27) is thinner in front than behind, where it passes directly into the walls of the lung cavity; the outer wall of the pericardium is thinner. The contracted yellowish-white ventricle of the *heart* was (flattened and) pear-shaped, about 7·5 mm. long; the atrium generally 12 mm. long; the atrio-ventricular valves (Pl. VI. fig. 11, *a*) are crescentic, with numerous thin habenæ musculares; the aortic valves were also conspicuous. The *truncus aortæ* (within the pericardium) (Pl. V. fig. 27) is strong, and is prolonged in front along the right side wall of the body, and there gives

[1] These species were determined by help of the Algologist, Kolderup-Rosenvinge.

[2] In *Onchidium palaense*, S., I found the contents of the digestive tract to be calcareous matter and sand, among which were many Polythalamia, and this seems generally to be the case in *Onchidium*. Cf. Semper, Einige Bemerkungen über die Nephropneusten v. Jherings, *Arb. aus dem Zool. Zoot. Inst. in Würzburg*, Bd. iii., 1877, p. 484, Note 1 ("Sie fressen wie die Holothurien nur Meeressand"). According to Joyeux Laffuie (*loc. cit.*, p. 14), the *Onchidium celticum* appears to live upon Algæ, especially Ulvæ, but it swallows a small quantity of sand to aid it in mastication.

off a strong gastro-hepatic artery above, which divides into several branches within the region of the cardia, for the supply of the stomach and the livers; the intestinal arteries and the posterior œsophageal artery are very strong. The main aorta is prolonged forwards to the region of the central nervous system, and then gives off the *aorta posterior*, accompanied on each side by two nerves; this enters the lower side of the anterior genital mass, then divides into numerous branches, and is prolonged backwards as the artery of the hermaphrodite gland. The anterior prolongation passes as the short *aorta anterior* between the pedal and pleural ganglia, and divides into (1) the pedal artery, which subdivides into an anterior and posterior branch which supply the foot, and into (2) the artery of the bulbus pharyngeus, which is prolonged forwards in the usual fashion, giving off the lingual artery, and a small branch to the foot gland.—The atrium of the heart receives the blood that has been arterialised in the lung by the *pulmonary veins*. The blood which enters the lung does so by means of the two *sinus laterales* (*circumpediaei*) and the *sinus pediaeus medianus*, into which the strong rete venosum of the foot empties itself; these large sinuses are in direct communication with the body cavity (by means of minute apertures in their walls), which forms a large *sinus venosus*, the two main divisions of this are united by fine pores in the septum lying between them.

The *lung* is of oval form (Pl. V. fig. 20), fastened above and on the outer side to the body-wall; the anterior wall passes into the pericardium. The length of the lung is 15·5 mm. by 10 mm. in breadth and 6 mm. in height; the outside is even. When opened the length of the cavity was 13 mm., the breadth 5·5 mm., and the height 5 mm.; the height and the breadth increased at the anterior and posterior extremities. The left wall and the left part of the lower wall of the cavity are smooth and yellowish in colour, and not covered by lung tissue. This latter covers the walls of the lung everywhere else (fig. 20), and is black; its free wall is spongy and reticulate; the structure of the lung appears to be precisely similar to that of other Pulmonata.[1] The *respiratory tube* (fig. 20, *a*) is short, about 4 mm. long, with fine longitudinal folds.

In the black lung tissue, and contrasting with it by its yellowish-white colour, is the *renal organ* (fig. 20), which measured 2·75 mm. in breadth. Its structure is as usual; the *urinary chamber*, which extends through the axis of the organ, is of rounded angular form and rather wide. I did not succeed in following the duct to an opening in the lung-cavity, nor did I find the renal syrinx, which certainly must have been present.[2]

The hindermost part of the visceral cavity is filled by a firm three-sided body, broader in front than behind (Pl. V. fig. 26, *a*; Pl. VI. fig. 12, *a*), which is 17·5 mm. long and 14·5 mm. broad by 11 mm. high. The anterior end was blunt and somewhat facetted; the hinder

[1] Semper, Beitr. zur Anat. und Phys. der Pulmonaten, *Zeitschr. f. wiss. Zool.*, Bd. viii., 1857, p. 370.

[2] Semper (*Arbeiten*, &c., Bd. iii., 1877, p. 485, Note) has observed the renal syrinx in *Helix* and *Vaginulus*. In a specimen of *Onchidium tumidum*, S., from Singapore, I found at the upper attachment of the atrium of the heart, enclosed in the spongy kidney tissue, a small organ with folds on the inside, covered with long cilia; this is certainly a *renal syrinx*.

end high, rounded; the upper side rather flat, with an impression of the upper side of the lung; the small right side is rounded with a longitudinal furrow beneath for the intestine (which in its last part runs over the vesicula seminalis); the larger left side is arched. The body consists of a smaller yellowish-brown hinder portion, the hermaphrodite gland, whose under margins embrace the greyish coloured seminal bladder; and a larger yellowish-white anterior portion, the mucous and albuminiparous glands (Pl. V. fig. 26, *b*; Pl. VI. fig. 12, *b*); both can be easily freed from each other. The *hermaphrodite gland* shows an arched upper surface traversed by fine furrows, but on the under surface there is a deep egg-shaped depression (for the seminal bladder); it is made up of two halves, nearly equal and not quite separated; in front and in the middle line, a portion of the yellowish-white hermaphrodite duct is visible upon its upper surface. The gland is as usual made up of a number of variously-sized lobes; the smallest lobes are pear-shaped (Pl. VI. fig. 13), with numerous ovarian follicles on the upper surface; there were no developed genital products. The short efferent ducts (fig. 13, *a*), which take their rise from these lobes, unite with each other to form thicker ducts; finally, there are two main ducts, forming a single duct, at the hilus of the gland, which runs over its upper surface with corkscrew-like windings, which when uncoiled have a length of 5·5 cm. with a diameter of ·6 mm. The duct opens behind on the under side of the anterior genital mass, near the albuminiparous gland.

The *anterior genital mass* (Pl. V. fig. 26, *b*; Pl. VI. fig. 12, *b*) is hardly half as large as the hermaphrodite gland; it is flattened on the upper side and arched on the lower side; the left half is larger than the right, and separated by a furrow, which is more conspicuous on the lower side. The left hand portion is more yellowish in colour; the right hand portion whitish, with finer windings (*albuminiparous gland*). The cavity of the mucous gland is narrow below, and passes into its narrow duct (fig. 12, *c*), which has fine longitudinal folds; the duct of the seminal bladder joins it at its base; it then becomes wider, its length being 15 mm., diameter ·9–1 mm.; it runs along the outside of the rectum as far as the body-wall, in which it then lies, and was followed with difficulty beneath the lung as far as the hinder portion of the (female) genital furrow to the vulva (Pl. V. fig. 2), this portion measuring 4 mm. in length. The outermost portion, the vagina, has fine longitudinal folds. The *seminal bladder* is spherical, about 10 mm. in diameter, of a dirty yellowish-grey colour,[1] and was filled with ochre-yellow débris; its duct is delicate and coiled, measuring when unrolled 15 mm. long.[2]—The end of the *hermaphrodite duct* behind, on the under surface of the anterior genital mass, bifurcates in the usual way at the albuminiparous gland; the *female branch* is short and opens near

[1] The anterior genital mass was so hardened that it was impossible to make out with certainty the relations of its constituent parts.

[2] Stoliczka (Malacology of Lower Bengal, I., On the genus Onchidium, *Journ. of Asiatic Soc.*, vol. xxxviii., part 2, 1869, p. 92) found the seminal bladder filled with a brownish-yellow mass, which contained bodies like sponge spicules, and others like the "peculiar arrows connected with the copulation of Helices." (??)

the albuminiparous gland; the male branch is continued in the *vas deferens*. This last is hardly thinner than the duct of the mucous gland, and accompanies it, being separated from it by a nerve cord, as far as its entrance into the side wall of the body; it could be traced in company with the vagina as far as the vulva, it then becomes thinner and bends forwards and runs in the outer lip of the female genital furrow as far as its anterior extremity (Pl. VI. fig. 12). In this long portion the vas deferens is firmly embedded in the substance of the lip, from which it cannot be freed; in transverse sections through the side walls of the body the vas deferens is seen within or near this same lip (compressed and perpendicularly oval) (Pl. VI. fig. 21, *c*), about ·25 mm. greatest diameter, with a very narrow cavity;[1] the course of the vas deferens along the body wall is (fig. 12) apparently quite straight. I could not follow it as far as the place where it appears to enter the frontal shield; within the last, but nearer the upper side, the vas deferens could be separated out, its course here is arched, the length of this portion being at least 4 mm. Beneath the right rhinophore, on the outer side of the common opening of the dart-gland and præputium (Pl. VI. fig. 12, *l*), the vas deferens is again free (it is of course only visible from the inside of the visceral cavity); for the first 8 mm. of its length it is somewhat thinner (fig. 12, *d*), it afterwards becomes about double the thickness, changes in colour from white to brownish-yellow, becomes of a somewhat softer consistency, and forms a coil, brownish coloured behind (fig. 12, *e*) and more yellowish in front (fig. 12, *f*); the length of this coil is about 8 mm., and its diameter is 6 mm.; when unrolled, this, the *prostatic portion* of the seminal duct (fig. 14, *ee*), was fully 24 cm. in length and ·4–·5 mm. in diameter. Through the axis of the coil runs an artery, and a strong connective tissue strand, which anteriorly (fig. 14, *i*) is prolonged into a muscle going towards the penis-sac (fig. 14, *k*). Behind the *prostatic portion* is continued into the *muscular part* (fig. 14, *f*) of the vas deferens, which forms the hindermost portion of the coil, and when unrolled has a length of 4·5 cm. Shortly before the muscular part of the vas deferens leaves the anterior end of the coil (Pl. VI. fig. 14, *k*), the strong *retractor penis* muscle is attached to it, which takes its origin behind at several points from the body-wall, in the neighbourhood of the anterior end of the pericardium; it is greatly swollen in the middle, and thinner where it is attached to the vas deferens (fig. 14, *i*); from this point the vas deferens takes its course to the penis, being slightly thicker (fig. 14, *g*); this portion of the vas deferens is 14 mm. long. The *penis* is about 3·5 mm. long, and pear-shaped; it is connected laterally with the dart-gland by a transverse cleft (fig. 15). The præputium is rather thick-walled, the interior has numerous longitudinal furrows and fine transverse folds; the upper portion of the cavity of the præputium is nearly filled by the glans, which is about 1·4 mm. long, cylindrico-conical, and lined by a strong yellowish cuticle (figs. 16, 17). The *glans* had a round aperture, filled by a small cylindrical evagination, which was perforated

[1] Semper, *loc. cit.*, Landmollusken, Heft v., 1880, Taf. xxii. fig. 20 (*Onchidium glabrum*, S.).

at its extremity by a minute circular orifice (fig. 17); the evagination was the anterior end of that portion of the tube provided with hooks. This *hook-bearing part* of the seminal duct was ·2 mm. in length, its diameter in front being ·3 mm., and further back ·16 mm.; the hooks were arranged as usual in longitudinal quincuncial series (Pl. VII. fig. 4); the number in the rows was twenty to twenty-five hooks (twenty in the anterior row, twenty-two to twenty-five in the posterior). The colour of these *hooks* was a faint yellow, they were usually strongly bent; in the anterior part their length was ·04 mm. The papillæ upon which these hooks are formed are conical, broader at the base, and running into a point above, upright or bent. They are made up of small nucleated cells. I observed a very similar structure in the hooks of *Triboniophorus*;[1] Semper[2] also in *Onchidium*. But I do not understand why Semper speaks of this structure as "cartilaginous," and of the hooks as "cartilaginous teeth." There is no trace here of any real cartilaginous structure. The penis, as already mentioned, opens laterally into the large sac of the dart-gland. The *dart-gland* (Pl. VI. fig. 12, *h*) is long and thick-walled, and with its many coils covers a large portion of the ampulla developed at its end (fig. 12, *ii*). The whole *gland* can be easily unravelled, and then attains a length of 45 cm.; its diameter is about ·75 mm., the windings of the gland are connected by connective tissue. This connective tissue appears to start from a low irregular frill, which winds itself spirally round the ampulla and fuses with it. The gland has a roundish, rather wide lumen, lined with a thick epithelium, and its wall has nearly the same macroscopic and microscopic structure as the ampulla. The gland suddenly becomes wider at the *ampulla*; this last is sausage-shaped, somewhat arched, and at each end rather more slender, dirty yellow coloured; when extended it measures 2·8 cm. by 5·5 mm. in diameter. In transverse section the lumen of the ampulla appears triradiate (Pl. V. fig. 25), lined by the above-mentioned epithelium. Sections coloured with picric acid showed the parts nearest the lumen and to the periphery most coloured; the crenate triradiate lumen is embraced by a thick circular layer, which was interwoven and surrounded outside by a more or less continuous longitudinal layer of fibres; between the central and peripheral coloured layers are delicate rings and arches of tissue, composed of circular fibres imbedded in connective tissue; here and there, especially in the peripheral layers, were spaces for blood-vessels. In similarly prepared sections of the gland itself, the structure was precisely similar, only the thin middle layer was more strongly developed, and the lumina of vessels more abundant. The duct of the dart-gland, which takes its origin from the anterior part of the ampulla (Pl. VI. fig. 12, *k*), is about as thick as the gland, or a trifle thicker, and is half as long again as the ampulla, which it resembles in structure; in front it opens (fig. 12, *l*, 14, *ab*) into a sac-like somewhat flattened organ about 6 mm. long. At the

[1] R. Bergh, Anat. Untersuch. d. Triboniophorus schütteii, K., *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, Bd. xx., 1870, p. 853, Taf. xiii., figs. 7–9.

[2] Semper, *loc. cit.*, Landmollusken, Heft v., 1880, p. 253, &c., Taf. xxii. figs. 4, 12, 16, Taf. xxiii. figs. 3, 5, 6, &c.

hinder end (fig. 14*k*) of this the fascicles of a strong retractor muscle become broader and are fastened; this last has several points of origin, apparently united with the above-mentioned retractor, on the under side of the anterior portion of the prostatic coil of the *vas deferens;* the flat belly of the muscle gives off a strong branch, which is attached to the under side of the sac and the duct of the ampulla, and then divides,—the end of the *vas deferens* passing between its branches,—becoming attached to the upper and lower sides of the sac. A number of irregular fascicles arising from the body-wall were attached to the dart-sac, and to the penis (fig. 14, *a*), and served the purpose of protractors. The *dart-sac* is deeply cleft at the hinder end for about half its length. The right half forms a small special sac—the *penis* (figs. 14, *h*, 15, *b*), which by a slit-like opening communicates with the middle of the cavity of the larger sack (fig. 15). The larger left half, which forms the proper sac of the dart (figs. 14, *b*, 15, *d*), has a strong, muscular, but not specially thickened, wall; its cavity is nearly filled with the strong *dart-cone;* through the narrow cavity of this the outer prolongation of the efferent duct, somewhat narrower quite at the end, runs towards the slit-shaped orifice at the point; in the last fourth this outer part of the duct was attached to the wall of the dart-cone, otherwise it was free and accompanied by one or two nerves, an artery, and two thin muscle-slips. The surface of the dart-cone is covered by a simple epithelium; towards the apex are a number of unicellular glands. On the inside of the muscular wall (fig. 18, *c*) of the efferent duct the proper duct of the gland (fig. 18, *d*) is to be found, with its epithelium and thick cuticle, which latter passes in front into the nearly cylindrical, about 4 mm. long, brown-yellow coloured strong dart. This *dart* (fig. 18, *a*), together with the proper duct, can be easily removed from the cavity of the outer duct. It is straight, somewhat swollen (fig. 18, *b*) in the hinder fifth, being here of about ·43 mm. diameter, while the apex is not generally more than ·18 mm.; the opening at its point lies at the side, and is dilated behind into a slit (fig. 20); the wall of the dart is rather thin, thicker quite posteriorly; in the wall the branched bone corpuscle-like cells were rather inconspicuous.

I did not succeed in making out the structure and relations of the *foot gland.*

To compare with this species I have also investigated the following species, which is closely allied to it.

Onchidium tonganum, Quoy et Gaimard (Pl. VI. fig. 19; Pl. VII. figs. 1–6).

Onchidium tonganum, Quoy et Gaimard, Voyage de l'Astrolabe, Zool. Moll., t. ii., 1832, p. 210, pl. xv. figs. 17, 18.
„ „ Semper, Reisen im Archip. d. Philipp., Th. II. Bd. iii., Landmollusken, Heft v., 1880, pp. 258–260, Taf. xix. figs. 2, 9, Taf. xxii. figs. 1, 2, 10.

Habitat.—Pacific, Indian Ocean.

The specimen which I investigated was obtained by Professor Reinhardt during the

cruise of the Danish vessel "Galathea" in 1846, and was taken in Pulu-Milu, one of the Nicobar Islands, on the 7th November, on the shore. It belongs to the collection of the museum at Copenhagen, and was handed over to me for study by Prof. Steenstrup. The specific name was verified by Semper, who investigated all the specimens of *Onchidium* in the museum. It was well preserved in alcohol, but rather contracted.

Its length is 7·5 cm., breadth 5·8 cm., height 3 cm.; the breadth of the mantle edge is 18 mm., of the foot 28 mm., and of the frontal shield 20 mm.; the edge of the foot projects 4 mm. in front; the length of the tail is 2·5 mm.; the length of the rhinophoria 4·5 mm.; the diameter of the pneumostome 2 mm.; the anal papilla is 1·4 mm. in length; the breadth of the aperture of the penis, which lies a little to the right, is 2 mm.

The position of the viscera was quite as in the last species. The pseudo-peritoneum was colourless, but greyish-black beneath and at the sides.

The *central nervous system*, the *rhinophoria*, and the *eyes* resemble those of the last species. I did not find the *otocyst*. Semper has accurately described the *dorsal eyes*;[1] in the specimen examined by me there appeared to be only a small number of groups of eyes, and a small number of eyes in the groups.

The *buccal tube* was about 9 mm. long by 9·5 mm. in breadth. The *bulbus pharyngeus* as above, but the upper side more gradually arched; its length was 11 mm., height 10·5 mm., and breadth 10 mm.; the radula-sheath, moreover, projected behind 4 mm. I found the usual *palatal plates*, which were longer, narrower, paler coloured and less conspicuous; in structure hardly different, save that the denticles were mainly conical and longer (about ·28 mm. long). The *tongue* presented no differences; in the chestnut-brown coloured radula there were forty-three series of teeth; further back forty-two, of which the four hindermost were not fully developed; the total number was thus eighty-five. The eight anterior series were much worn, even their median teeth, and also the following series, but in a less degree. In the hindermost rows of the tongue there were 106 teeth (on either side), further back the number did not increase to more than 108. The shape of the teeth was hardly different from that of the last species.

The *salivary glands* were also similar; the left gland 12 mm. long, 8 mm. broad, and 2·5 mm. thick, somewhat bent, and traversed by furrows on both sides; otherwise fairly smooth, the margin lobate. The right gland is a little shorter and thicker, and rather more lobate.

The *œsophagus* resembles that of the previously described species; its length is 3 cm., and the diameter 3 mm. anteriorly and 1·5 mm. posteriorly. The *first stomach* is irregularly spherical, about 8 mm. long by 8·5 mm. in diameter; inner surface like that of the previously described species. The *second, masticatory stomach*, is 12 mm. long, 16 mm. broad, and 11 mm. in thickness; its form and the tendinous patches are like

[1] *Loc. cit.*, Landmollusken, Ergänzungsheft, 1877, p. 4, Taf. A. fig. 2; Taf. B. figs. 3, 4; Taf. C. fig. 9.—Heft v. 1880, p. 258.

those of the last described species; the thickness of the walls of the stomach is as much as 5 mm.; the cuticle and the thicker portions of the stomach as above, but less marked. The *third, lamellated stomach*, does not differ at all from that of the last species; it is in the same way radially pigmented, oval, and depressed in form; the greatest diameter 12 mm., the less 9 mm., the height only 4·5 mm.; the band mentioned above as lying between the second and third stomachs exists here also; the height of the leaves reaching about 3·5 mm.; their structure is precisely similar. Two of the folds of the third stomach are continued about 9 mm. into the intestine and then unite, the end hanging loose about 1 mm. from the wall; in this region of the intestine there is, moreover, a zone of short longitudinal folds. The *intestine* has a length of 15 cm. and a diameter of 2–2·5 mm.—The *cavity of the alimentary tract* was filled with a dirty yellowish-white mass, mainly consisting of littoral Algæ, calcareous matter, and Foraminifera; there were also pieces of the radula that had been torn off, even portions of teeth-series, often with as many as eight to twelve teeth.[1]

The most *anterior* of the three greenish-yellowish-grey *liver masses* measured 22 mm. in length by 19 mm. in breadth and 12 mm. in height; on its right margin were two deep obliquely running furrows which united anteriorly, and between them a shorter one; on the left margin was a single deep furrow. The *lower liver* was 22 mm. long by 8 mm. broad and 7 mm. thick, divided into four separate lobes by deep furrows. The *hinder liver* concavo-convex, 23 mm. long, 18 mm. broad, and 6 mm. thick, divided into six lobes by two deep furrows on the left and three on the right. The hepatic ducts and their apertures as in the former species.

The milk-white *pericardium* is precisely similar to that of the former species, the hinder portion imbedded in the lateral parts of the back; the anterior portion is freer and attached by short bands to the back and the right lateral wall of the foot. The pericardium is compressed, of oval contour, 24 mm. long by 14 mm. broad; the anterior portion occupying the first 17 mm. of its length, is thin-walled, and permits the heart to be seen within; the posterior portion shorter, and thicker behind, joins the wall of the lung. The *heart* is like that of the last species; the length of the contracted ventricle was 6·5 mm., the breadth (from above downwards) of the atrium is 14 mm. The *aorta* extends to the anterior end of the upper liver, between it and the intestine, where it gives off the strong gastro-hepatic artery upwards, and then, as usual, is continued forwards and backwards; branches of the anterior œsophageal artery supply the salivary glands.

The cavity of the *lung* is pretty wide, about 13·5 mm. long by 12 mm. in height and 8 mm. in breadth; the inner wall is thin but tough; in front it joins the hinder wall of the pericardium; the inner side, as well as the neighbouring portion of the lower wall of

[1] Semper (*loc. cit.*, Ergänzungsheft, p. 30) says that the *Onchidia* do not feed upon plants or animals, but take in only sand and mud. In nineteen species which he examined, Semper found "nothing but sand and mud."

the lung cavity, is smooth. Otherwise the walls of the cavity are thick, yellowish-grey coloured, spongy on the surface. Along its length the middle part of the right wall stands out somewhat, and is prolonged backwards, being traversed by the respiratory tube. In front, above and below, the wall for a certain space projects somewhat above the general level, and is here of a yellowish colour ;[1] these parts, however, are only produced by the peripheral development of the *kidney*. On transverse sections being made through the thicker parts of the walls of the lung, the yellowish kidney is clearly visible in its interior with a roundish lumen ; the cavity of the kidney could be followed beyond the pneumostome ; the renal pore is said to be situated "behind the anus" (Semper),[2] but I did not succeed in discovering it ; it seemed much more likely that the kidney opened by a cleft within the respiratory cavity, and thus into the lung. I was unable to detect a renal syrinx.

The *hermaphrodite gland* is about 10·5 mm. long by 15 mm. broad and 11 mm. high, of yellowish colour ; it is made up of two equal halves, each of which is again composed of numerous smaller parts ; in the lobes were large oogene cells and zoosperms. The *hermaphrodite duct* arises by two branches from the hilus of the gland, and is coiled in a cork-screw fashion ; when unwound it measured 6 cm. long by ·8–1 mm. in diameter ; it enters the hinder part of the anterior genital mass.—The *anterior genital mass* is 22 mm. long by 14·5 mm. high and 16 mm. broad ; it is irregularly heart-shaped, flattened obliquely behind by the hermaphrodite gland ; the right margin is convex and crenate, the left margin straight and flattened ; the upper side is a good deal covered by the hinder liver, and is somewhat flattened ; the under side is arched. This genital mass is made up of a larger yellowish part, which by a notch on the right margin is divided into two equal parts (*mucous gland*), and a smaller whitish portion (*albuminiparous gland*) which occupied the middle of the left half, especially on the under side. The female branch arising from the hermaphrodite duct opens near the albuminiparous gland. In the mucous duct, near its origin, opens the duct of the *seminal bladder*. This last lies behind and below the anterior genital mass, filling the apex of the visceral cavity ; it is yellowish and of a somewhat flattened-spherical form, about 10 mm. in diameter, filled with detritus and fatty matter. The duct of the seminal bladder is rather thin and much coiled ; when unrolled it measures at least twice as much as the bladder. The *mucous duct*, which runs along the outside of the rectum, is thin ; for the first 8 mm. it runs obliquely backwards to the right side of the body, held in position by several obliquely crossing bundles ; the duct, about 5 mm. in length, then passes further out, just under the lung, and extends as far as the vulva, which forms a small slit just (about 7 mm.) in front of the respiratory cavity, about the hinder end of the genital furrow ; this vagina has folds on

[1] H. v. Jhering, Ueber die system. Stell. von Peronia, 1877, p. 18. He regards this last portion as an additional kidney, which only has a delicate covering of spongy (lung) tissue.

[2] Semper, Einige Bemerk. über die Nephropneusten, *loc. cit.*, p. 486.

the inside, with a thick epithelium; the diameter of the duct is about 0·5 mm. The *male branch* of the hermaphrodite duct is immediately continued into the *vas deferens*, which follows the same course as in the previous species; it accompanies the vagina and the duct of the mucous gland, and becomes imbedded in or near the outer lip of the "genital" furrow,[1] and is continued as far as its anterior end, where it apparently bends inwards, crosses through the frontal shield, and becomes again free on its inner side. The first 6 mm. of the vas deferens are delicate and whitish coloured; it then becomes about twice as thick and more yellowish coloured, and forms a coil which measured 11 mm. long by 5 mm. in diameter, and behind is of a rather clearer yellow colour; it then continues straight from the place of insertion of the retractor muscle (Pl. VII. fig. 3, *c*) for the space of about 6 mm. to the penis (fig. 3, *b*); when unravelled and extended the vas deferens measures some 20 cm.[2] by ·4 mm. in diameter; the difference in colour between the prostatic and muscular portions of the duct is not very conspicuous. The *penis* (Pl. VII. fig. 3, *a*) is short and sac-shaped, a little flattened, 4·5 mm. long by 2·5 mm. broad; its cavity opens laterally by a slit into the middle of the sac of the dart-gland. The præputium of the penis is like that of the previously described species; its cavity is clothed with a thick yellow cuticle and has strong transverse furrows, it is nearly filled by the short thick glans (fig. 3) with its cylindrical truncated prolongation, black on account of the hooks (fig. 3). This protrusible end of the vas deferens is 1·6 mm. long by ·35 mm. in diameter; the hooks are arranged as usual in longitudinal quincuncial series (fig. 4), about twelve or fifteen rows at the base of the protrusible part and fifteen to twenty at the point, and more backwards in the interior generally twenty-two to twenty-five; these hooks (fig. 4) were of the usual form, attaining a height of ·035–·045 mm., dirty yellow coloured, inclined to brown upon the base. The portion of the vas deferens armed with hooks does not extend backwards beyond the base of the penis; the whole length of this portion is not more than 6 mm. In the last straight portion of the vas deferens (fig. 3, *bb*) the proper seminal duct itself winds down in a cork-screw fashion, but goes straight in the other parts. The retractor muscle of the penis (fig. 3, *c*) is rather shorter than in the previous species,[3] at least 8 mm. long, and about the same breadth as the vas deferens throughout.—The *dart-gland* covers the largest part of its ampulla with its own windings; when unrolled it measured ·51 cm. by ·8–1 mm. in diameter;[4] its structure is as above described. The *ampulla of the gland* has again the same form and structure; its length is 2·5 cm. and diameter 4·5 mm. The duct, which takes its rise from the anterior end of the ampulla, is coiled, when unrolled it measures 2·5 cm., and is hardly thicker than the gland. The strong *retractor sacci hastatorii* and the protrusors are quite as

[1] At the bottom of this furrow there was a fine longitudinal fold, whose sides were traversed by other folds; a similar condition was found by Semper (*loc. cit.*, Taf. xxii. fig. 20) in *Onchidium glabrum*.

[2] Semper (*loc. cit.*, p. 259) describes the length of this portion as being over 20 cm.

[3] According to Semper (*loc. cit.*, p. 259, Taf. xxii. fig. 10, *rp.*), the retractor muscle of the penis is much shorter.

[4] Semper (*loc. cit.*, p. 259), in a specimen measuring 5 cm., found the gland to have a length of 80 cm.

in the previous species. The *dart-sac* also is like that of the previous species; it is 6 mm. long by 3 mm. in diameter, its wall is not thick, the inside is covered with fine transverse furrows, the cuticle is thin; the cavity is filled by the short conical *dart-cone* (Pl. VII. fig. 5, *a*); the duct (fig. 5, *b*) of the gland, accompanied by two nerves (fig. 5, *d*) and several muscle-slips (fig. 5, *e*), could be followed to the depressed hinder end of the cone; the opening on the apex of the cone was a fine slit; the surface of the cone is covered by a low, beautiful large-celled epithelium. The opening on the apex of the cone leads into its cavity, whose walls are thicker and yellower in the outer portion; farther back the walls are thinner, on which account the enclosed *dart* (fig. 5, *c*) is dimly visible through; behind, the walls are continuous with the base of the dart, which is slightly moveable in the cavity. The *dart* (fig. 6, *ab*) has a whitish thick basal portion about 2 mm. long; the rest measures 4·25 mm. by ·37 mm. in diameter behind, and ·15 mm. at the apex, in other parts its diameter is about ·2 mm. It is straight and stiff, and brownish coloured; the lumen is circular, the walls thin; the opening on the apex is obliquely cut off (fig. 6, *a*), the margin at the side springs out as a short rounded projection, whence the aperture is of an oval form and generally varies in appearance according to the different positions (Pl. VI. fig. 19). The structures first observed by Semper[1] in this and other species in the form of branched cells like bone corpuscles, I have myself observed here (and in several other species) in the substance of the walls. These cells are here of a longish oval form, generally ·016–·020 mm. long, with a small nucleus; they are not frequently branched, but more generally simply drawn out at both ends; they are only found in the anterior half of the dart, and especially near its point. These cells have probably wandered into the chitinous tube during its development from the *membrane*, which clothes the *inner side of the chitinous tube* and is formed of small cells.

On carefully removing the intestines the whitish *foot gland*[2] (fig. 2, *b*) comes into view, about ·5 cm. behind the opening of the mouth-tube (fig. 2, *a*), in a slit behind the anterior ends of the two superficial pedal muscles, which here cross. Its length was 4 mm., breadth 2·5 mm., and height the same; it was a little egg-shaped (Pl. VII. fig. 1), higher in front than behind, with a longitudinal furrow along the sides, flattened on the under side, arched above. The duct (fig. 1, *b*) was about as long as the gland, wider in front than behind, and taking its origin from the anterior part of the gland; it had a funnel-shaped opening behind the end of the genital furrow. The wide cavity extended through the

[1] Semper, *loc. cit.*, pp. 260, 263, 264, Taf. xxii. figs. 1, 3, 13, Taf. xxiii. figs. 4, 11.

[2] In the genus *Triboniophorus* the foot gland extends much more into the body cavity (Keferstein, Ueber die zweitentakeligen Landschnecken, *Zeitschr. f. wiss. Zool.*, Bd. xv., 1864, p. 84, Taf. vi. fig. 4, *gp*,—and R. Bergh, Anat. Untersuch. d. Triboniophorus schütteii, K., *Verhandl. d. k. k. zool.-bot. Gesellsch. Wien*, Bd. xx., 1870, p. 850), also in *Limax pectinatus*, Selenka (Malacolog. Blätter, 1865, p. 107, Taf. ii. fig. 3, *gp*), in *Janella* (Keferstein, Ueber d. Anat. d. Janella bitentac., *Zeitschr. f. wiss. Zool.*, Bd. xv., 1865, p. 449, Taf. xxxiv. fig. 3, *gp*), and partly in *Limax marginatus*, Drp. (*Zeitschr. f. wiss. Zool.*, Bd. viii., 1857, p. 351 (Semper)); in *Philomycus*, on the other hand, and certain species of *Onchidium* (*Onchidium tumidum*, S.), the gland is enclosed in the foot (R. Bergh, *loc. cit.*, pp. 860, 865), or partly free (Keferstein, Zur Anat. von Philomycus carolinensis, *Zeitschr. f. wiss. Zool.*, Bd. xvi., 1866, p. 187, Taf. ix. fig. 2, *gp*).

entire length of the gland, the lateral walls especially projecting along the middle of the length; the walls of the cavity were somewhat spongy; the gland follicles appeared to be quite like those of other species. The walls of the efferent duct had fine longitudinal folds. This gland is perhaps in some way connected with the genital function, perhaps oviposition.

For comparison I further examined the following species.

Onchidium verruculatum, Cuvier (Pl. VII. figs. 7–12; Pl. VIII. fig. 14).

Onchidium verruculatum, Cuvier, Règne Animal, 2me éd., t. iii., 1830, p. 46 (footnote[1]).
„ „ Semper, *loc. cit.*, pp. 255–257, Taf. xxi. fig. 1; Taf. xxii., figs. 3, 4.

Habitat.—Indian Ocean.

I investigated a single specimen of this species, which was taken during the "Galathea" Expedition, by Prof. Reinhardt, in February 1846, on the north shore of Sambelong (Great Nicobar), in the Ganges Harbour. The specimen had been determined by Semper.

The specimen had been well preserved in alcohol, and was only slightly contracted; it was 3·3 cm. in length, 2·3 cm. in breadth, and 1·1 cm. in height; the breadth of the mantle edge 4·5 mm., of the foot 18 mm., of the head 15 mm.; the length of the rhinophoria 3 mm.; the free anterior edge of the foot projects 2 mm.; the length of the tail is 2·5 mm., the width of the pneumostome 2 mm.

The pseudo-peritoneum is black in colour, its diaphragm greyish. The position of the organs of the body was quite as in the previous species.

The *central nervous system*[2] as above; the pleural ganglia were, however, relatively larger than in the specimens previously investigated. The *dorsal eyes* (Pl. VIII. fig. 14) which have been accurately described by Semper,[3] were present in small numbers; I counted about twenty groups of eyes, each containing from three to four; their structure was as described by Semper. The *rhinophoria* and the *eyes* situated upon them as usual; the cavity of the former was entirely free from pigment. I did not succeed in discovering the *otocysts*.

[1] In the second édition of the Règne Animal, Cuvier named the *Onchidium*, figured in the Déscription de l'Égypte, *Onchidium verruculatum*. This name was first adopted by Keferstein (Einige Bemerk. über d. Geschlechtsorg. von Peronia verruculata, Cuvier. *Zeitschr. f. wiss. Zool.*, Bd. xv., 1864, p. 91) for individuals from Java and Japan. But this identification appeared probable first through the comparative researches of Semper (*loc. cit.*, 1880, p. 256), who had investigated a number of individuals from the Red Sea to beyond the middle of the Pacific of this widely distributed species.

[2] The nervous system is treated of by v. Jhering (*loc. cit.*, p. 230, Taf. iv. fig. 16).

[3] *Loc. cit.*, Landmollusken. Ergänzungsheft, 1877, p. 4, Taf. A. fig. 5; Taf. B. figs. 1, 2;—Heft v., 1880, pp. 255–256.

The *buccal tube* is 4·5 mm. long, the interior as usual; the protrusor muscles are covered at their origin with a pigmented sheath. The *bulbus pharyngeus* about 6 mm. long, 5·5 mm. broad, and 3·5 mm. high; the large radula-sheath (with the dark prolongation of the radula) only projects slightly. The *palatal plates*, and their denticles, quite as strongly developed as in the former species. The *tongue* is as usual; in the dark amber-coloured glittering radula there were thirty-three series of teeth (counted along the outer margin); further back there were thirty-one series, of which four were incompletely developed; the total number is thus sixty-four. The fifteen or sixteen anterior rows were more or less incomplete,[1] and the teeth themselves frequently worn out; in the hindermost rows of the tongue there were eighty teeth on each side, and the number appeared not to increase notably further back.[2] The *teeth* in colour and shape were quite like those of other species; the median teeth (Pl. VII. fig. 9, *a*,*a*) perhaps a little longer and broader behind.

The *salivary glands* are of nearly equal size, yellowish-white and of irregularly oval form, 6 mm. at their greatest diameter, by 3·75 mm. to 4 mm. in length, and 2 mm. to 2·5 mm. in thickness; the outer surface smooth and convex, the inner very uneven. The gland is made up of a number of variously sized lobules united (fig. 10). The duct has an outer pigmented sheath, it is 3 mm. long.

The *œsophagus* forms a short ampulla, 1·6 mm. broad, just behind the pharynx, pigmented black on the outside, the folds of the interior were stronger here than elsewhere; the whole length of the œsophagus is about 13 mm., and its diameter 1 mm. to 1·3 mm. The *first stomach* is pear-shaped, its length and diameter being about 4·3 mm. The *masticatory stomach* is of the usual form and appearance; its breadth is 9·5 mm. with a length of 7 mm. and a height of 5·5 mm.; the thickness of the walls reaches 4·2 mm.; the structure is quite similar to that of the previous species, and even more easy to see; the band between it and the third stomach is quite as usual. The *third stomach* is strongly pigmented (black) on the left and upper sides, and somewhat depressed; its greatest diameter about 7 mm., its least 3 mm.; the lamellated structure as usual, the height of the leaves reaches to 2·2 mm., the number of the largest and medium sized leaves is about thirty, between them are moreover a number of small ones; two of these leaves fused together are also seen continued into the intestine. The *intestine* had a length of about 9·5 cm. by a breadth of 1·8 mm. to 1·2 mm.—The contents of the alimentary tract were littoral Algæ, sand, and calcareous mud, portions of sponges, Diatomaceæ, and Polythalamia; frequently there were to be found teeth of the radula of the animal itself.

The *livers* had a dirty greyish-yellow colour, the upper surface covered with white points.[3] The anterior liver is about 11 mm. long by 7·5 mm. broad and 4 mm. in

[1] The anterior row was reduced to a median and one lateral plate, the following series to :—5–1–7, 7–1–5 . . . 4 . . 3, 26–1–30, and so on.

[2] Semper (*loc. cit.*, p. 257) describes 131 teeth in each properly developed row.

[3] The white points were possibly the eggs of some parasite.

height; it is very lobate, the number of the larger lobes being about six. The lower liver is 10 mm. long by 5 mm. broad and 3 mm. in thickness, the number of the larger lobes being here three. The hindermost liver is 7 mm. long by 6·75 mm. in breadth and about 2·5 mm. in height; it is, like the others, markedly lobate. The structure is quite as usual; the hepatic ducts open in the usual way.

The *pericardium* on the inside is, like the visceral cavity, strongly pigmented; its contour is oval, and the length about 8 mm. The *heart* is as usual; the gastro-hepatic artery is very stout, and extends along the under surface of the stomach, giving off a special branch to each stomach, and to each of the liver masses.

The *lung cavity* is rather narrower than in the preceding species, and about 6 mm. long; its brownish-grey walls are of the usual structure; the respiratory tube is 3·5 mm. long, with longitudinal folds. The *kidney* contrasts with the lung cavity by its whitish colour.

The *hermaphrodite gland* is pale brownish-yellow, and consists of two imperfectly-separated halves. The spermatozoa attain a length of ·4 mm., the head alone ·013 mm. long. The duct is formed of two chief branches, and projects from the hilus of the gland; these branches are each subdivided into two or three twigs; the common hermaphrodite duct is long and spirally wound; when fully stretched the length is 2·5 cm., and the diameter ·5–·7 mm.—The *anterior genital mass* has the form of a short truncated pyramid, with the base directed upwards and anteriorly; its length is 9·5 mm., the breadth of the base 9 mm., and the height 8 mm.; the hinder end of the mass is formed by the seminal bladder. The duct of the mucous gland was followed as far as the vulva (fig. 7, *c*); the *spermatheca* is as usual, its duct slightly longer than the organ itself. The *vas deferens*, running along the vagina, could be traced as far as the outer lip of the genital furrow, considerably thinner than the vagina; the course of the vas deferens along the genital furrow as in the previous species. It is colourless as far as its entrance into the body cavity (beneath the right rhinophore), and was followed in its way through the frontal shield; it then becomes black in colour, and a little thicker for about 1 mm. in length, and then increases about four times in thickness, and forms a coil, blackish-brown in colour, which, when unrolled, measured 5·5 cm. and ·3 mm. in diameter; this coil then passes into another, smaller, more longish and whitish in colour, which measured 5 cm. The thickness of this last *muscular* portion of the vas deferens is a little less than that of the *prostatic part;* the last portion of the muscular part is straight, and measures 1 cm. in length, and is about half as thick as the rest of this part. The *penis*, as already stated by Semper,[1] is of unusual length—5 mm.; it is cylindrico-conical in shape, and measures behind ·75 mm. in diameter and 2 mm. in front; its cavity opens into the male genital cleft, close to the dart-sac. The præputium is thick-walled, with strong transverse furrows on the inside; at the base of its cavity is the opening of the vas deferens, the anterior part of this was

[1] *Loc. cit.*, p. 259.

evaginated as a low papilla armed with hooks. The whole armed portion of the vas deferens was about 3 mm. long, by about ·08 in diameter, increasing to ·1 mm. on the point. The number of the longitudinal rows of hooks towards the point was twenty-five, arranged quincuncially; farther back there were twelve to fifteen;[1] in a single row I counted about 170 hooks. The *hooks* are yellow coloured, slightly bent, the hindermost being ·02 mm. long;[2] their form and structure as usual. The retractor muscle of the penis is much as usual, but rather longer, as Semper[3] has already stated. The *dart-gland* is a large yellowish coil of about 4 mm. in diameter; unrolled, its length was 10 cm. by about ·5 mm. in breadth; its lumen and structure are as usual. The gland gradually passes into the *ampulla*, which was of an elongated spindle shape, and measured 7 mm. in length by ·8 mm. in diameter; its very narrow cavity is roundish in section, the structure being as usual. The *duct* of this gland is a little longer than the ampulla, and a little thicker than the gland, with strong walls (fig. 11, *d*). The *dart-sac* is elongated-conical, slightly bent, and 7·5 mm. long, with a diameter of ·9 mm. posteriorly, and 2 mm. in front; its anterior end, like the anterior margin of the præputium, is black. The inside of the thick walls shows strong transverse folds above, and slight longitudinal ones beneath; behind, quite at the base of the sac, is the depressed *dart-cone* (fig. 11, *a*), in the cavity of which is the *dart* (fig. 11, *b*), the darker basal portion of which (fig. 11, *c*) is visible through the walls of the sac. The dart[4] is straight, pale yellowish in colour, dirty brownish-yellow at the root; its length is 1·76 mm., and diameter ·03 mm. at the apex, ·16 mm. at the base; the aperture (fig. 12, *a*) at the apex is in form nearly like that of the previous species—circular; the walls of the dart contain the usual cells, especially towards the apex (fig. 12), where they are also larger. The retractor and protrusor muscles of the dart-sac are as usual.

About half (1 mm.), of the white *foot gland* (fig. 8, *b*) projected freely in the middle line; the gland is somewhat more flattened than in the previous species, the cavity extends through the entire length of the gland; the duct is generally as long as the gland itself, and opens by a narrow slit; just in front of the opening is the end of the genital furrow.

[1] Semper (*loc. cit.*, p. 257) gives the number of "cartilaginous teeth' in the "rings" as twenty or more in front.
[2] According to Semper (*loc. cit.*, p. 257) the height is ·02 to ·07.
[3] *Loc. cit.*, p. 259.
[4] Semper has already (*loc. cit.*, Taf. xxii. fig. 3) figured the dart.

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PLATE I.

PLATE I.

Figs. 1–12. *Archidoris kerguelenensis*, Bergh.

Fig. 1. Central nervous system, from above; *a, a*, pedal ganglia at the outer side of cerebro-pleural ganglia, near to them are the eyes and proximal olfactory ganglia; *b*, the united sub-cere-bro-pleuro-pedal commissure; *c*, buccal and gastro-œsophageal ganglia; *dd*, sanguineous gland. Cam. luc. × 200 diam.

Fig. 2. Tubercle of skin. Cam. luc. × 200 diam.

Fig. 3. Portion of rhinophorial leaf. Cam. luc. × 350 diam.

Fig. 4. Two innermost teeth; *a*, first lateral tooth; *b*, second lateral tooth. Cam. luc. × 350 diam.

Fig. 5. Large lateral tooth, from the inner side. Cam. luc. × 200 diam.

Fig. 6. Large lateral tooth, from the outer side. Cam. luc. × 200 diam.

Fig. 7. Innermost portion of a series of teeth; *a*, rhachidian fold; *b*, the first; *c*, the eighth tooth. Cam. luc. × 200 diam.

Fig. 8. Portion of series of largest teeth. Cam. luc. × 200 diam.

Fig. 9. Outermost portion of a series of teeth; *a*, the outermost; *b*, the fourth tooth. Cam. luc. × 350 diam.

Fig. 10. *a*, Stomach; *b*, intestine; *c*, renal chamber.

Fig. 11. *a*, Spermatheca; *b*, its chief duct (vagina); *c*, spermatocyst; *de*, uterine duct.

Fig. 12. *a*, Spermatic duct; *b*, penis (the præputium is opened and the glans visible).

Figs. 13–18. *Archidoris australis*, Bergh.

Fig. 13. The central nervous system, from above; *ab*, cerebro-pleural ganglia; *c, c*, pedal ganglia; *d*, common commissure; *e, e*, proximal olfactory ganglia; *f*, distal olfactory ganglia; *g*, buccal ganglia; *h, h*, gastro-œsophageal ganglia; *i*, nervus genitalis issuing from ganglion genitale. Cam. luc. × 100 diam.

Fig. 14. Part of the margin of the branchial groove.

Fig. 15. Tubercles of the skin. Cam. luc. × 100 diam.

Fig. 16. Two of innermost lateral teeth; *a*, the innermost. Cam. luc. × 350 diam.

Fig. 17. Teeth of two different series from the outer side. Cam. luc. × 350 diam.

Fig. 18. Outermost portion of two different series of teeth with five and three teeth; *a, a*, the outermost ones. Cam. luc. × 350 diam.

Figs. 19–22. *Discodoris morphæa*, Bergh.

Fig. 19. Otocyst on the surface of the cerebral ganglion (*a*). Cam. luc. × 350 diam.

Figs. 20, 21. Spicules from skin. Cam. luc. × 200 diam.

Fig. 22. *a*, Œsophagus; *b*, stomach, behind which is the upper portion of the gall bladder; *ccc*, intestine; *dd*, liver.

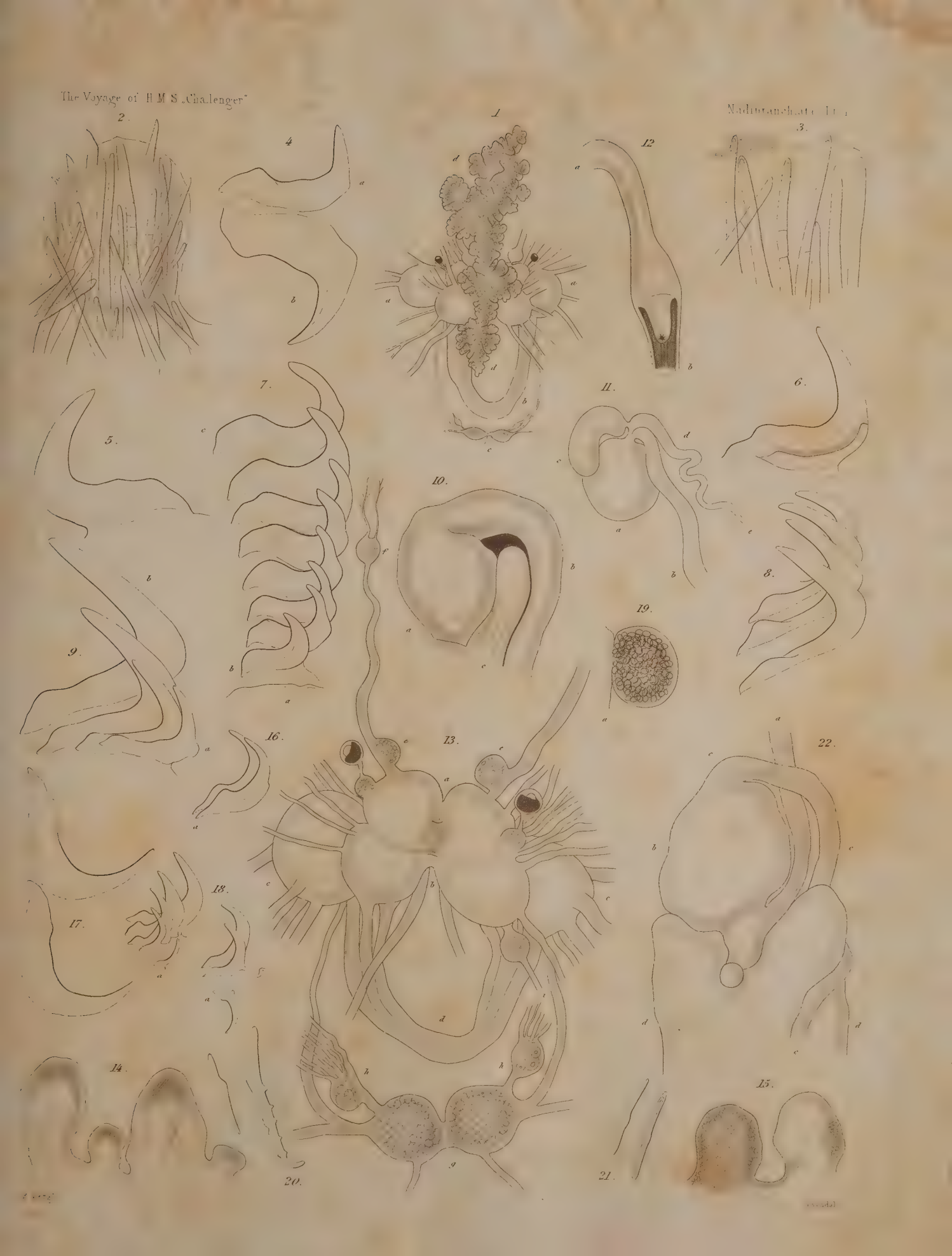
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PLATE II.

PLATE II.

Figs. 1–12. *Discodoris morphæa*, Bergh.

Fig. 1. Median section of a dorsal tubercle. Cam. luc. × 200 diam.

Fig. 2. Prehensile ring; *a*, upper part; *b*, lower part. Cam. luc.

Fig. 3. Portion of upper end of the same. Cam. luc. × 750 diam.

Fig. 4. Points of some of the elements from above. Cam. luc. × 900 diam.

Fig. 5. Middle portion of the radula; *a*, rhachidian fold; *b*, *b*, *b*, first lateral teeth. Cam. luc. × 350 diam.

Fig. 6. One of the largest teeth, from the outer side. Cam. luc. × 350 diam.

Fig. 7. Another, from the inner side. Cam. luc. × 350 diam.

Fig. 8. Another, seen obliquely from the under surface. Cam. luc. × 350 diam.

Fig. 9. Outermost part of two series of teeth; *a*, outermost tooth; *b*, the sixth; *c*, cuticular folds. Cam. luc. × 350 diam.

Fig. 10. Part of the pulp of the radula; *a*, posterior; *b*, anterior part. Cam. luc. × 350 diam.

Fig. 11. Salivary glands; *a*, *a*, efferent ducts; *b*, *b*, hinder attenuated ends of the glands.

Fig. 12. *a*, Spermatocyst; *b*, inner portion, *c*, outer portion, of uterine duct.

Fig. 13. *Archidoris australis*, Bergh.

Fig. 13. Portion of kidney; *a*, urinary chamber. Cam. luc. × 55 diam.

Figs. 14–17. *Ceratosoma cornigerum*, Adams.

Fig. 14. Anterior end of Bulbus pharyngeus, with the labial disk and the oral aperture.

Fig. 15. Outer part of three series of teeth; *a*, *a*, outermost teeth. Cam. luc. × 750 diam.

Fig. 16. *a*, Muscular part of vas deferens; *b*, upper solid portion of penis; *c*, its termination in the præputium.

Fig. 17. *a*, Spermatheca; *b*, vaginal duct; *c*, vagina; *d*, uterine duct; *e*, spermatocyst.

Figs. 18–24. *Platydoris eurychlamys*, Bergh.

Fig. 18. Median part of radula; *a*, *a*, first lateral teeth. Cam. luc. × 350 diam.

Fig. 19. Outermost parts of three series of teeth (5–5–2); *a*, *a*, *a*, outermost teeth. Cam. luc. × 350 diam.

Fig. 20. Two outermost teeth; *a*, supplementary tooth. Cam. luc. × 350 diam.

Fig. 21. A dorsal tubercle. Cam. luc. × 200 diam.

Fig. 22. *a*, Spermatheca; *b*, vaginal duct; *c*, vagina; *dd*, uterine duct; *e*, spermatocyst.

Fig. 23. Upper portion of penis, opened to show the glans within the præputium and several disks. Cam. luc. × 100 diam.

Fig. 24. Hooks of two of these disks. Cam. luc. × 350 diam.

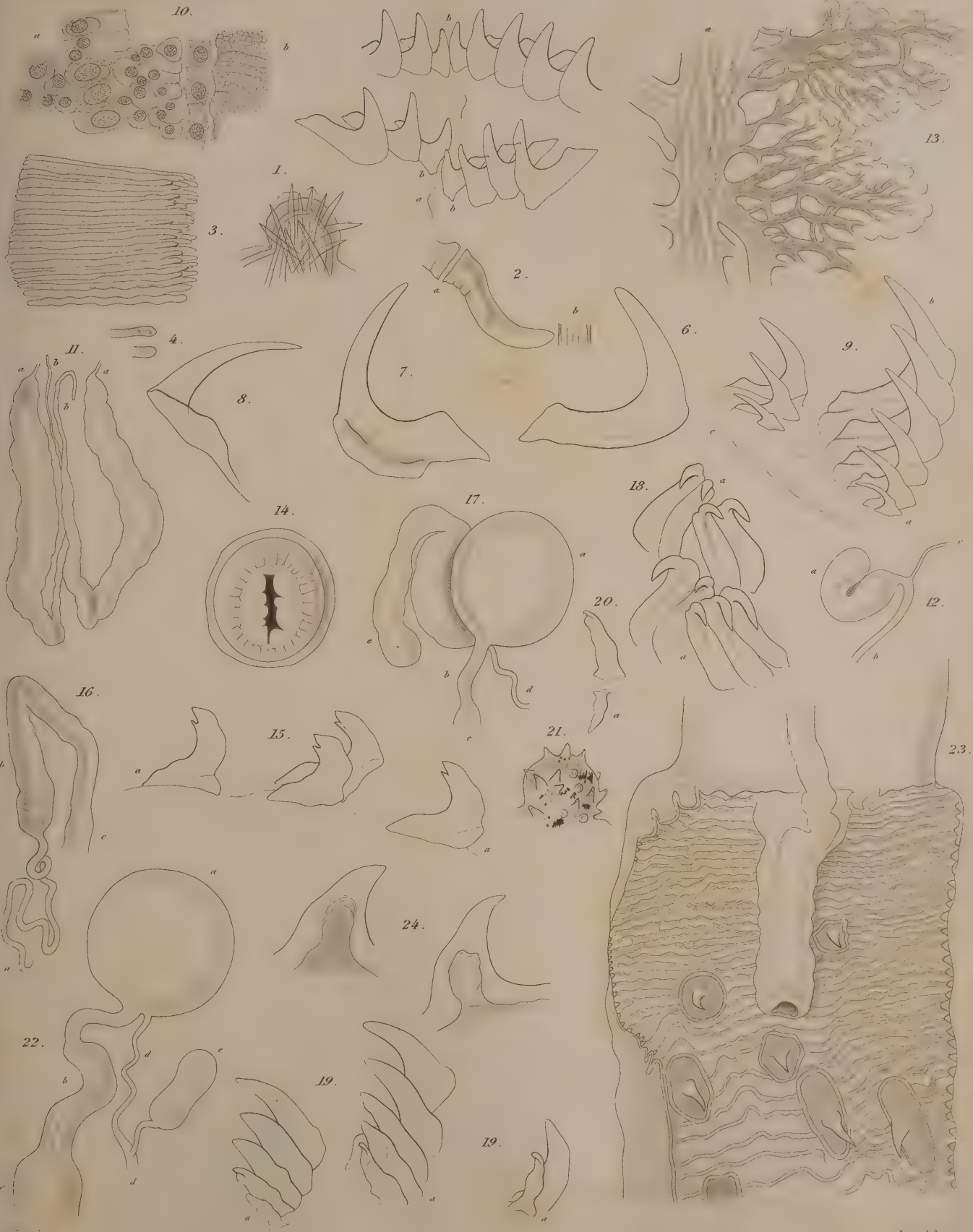
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PLATE III.

PLATE III.

Figs. 1–12. *Platydoris eurychlamys*, Bergh.

Fig. 1. *a*, Buccal ganglia; *b*, *b*, gastro-œsophageal ganglia. Cam. luc. × 55 diam.
Fig. 2. *a*, Proximal; *b*, distal, olfactory, ganglion. Cam. luc. × 55 diam.
Fig. 3. *a*, Œsophagus; *b*, stomach; *cc*, intestine; *d*, bile-duct; from beneath.
Fig. 4. *a*, Cleft at anterior end of duct of renal syrinx (*b*).
Fig. 5. Arborescent outgrowths of duct of renal syrinx. Cam. luc. × 100 diam.
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Fig. 7. One of the smaller disks of the præputium, from above. Cam. luc. × 350 diam.
Fig. 8. Hooks of two of the larger disks, from the side. Cam. luc. × 350 diam.
Fig. 9. Lower part of præputium. Cam. luc. × 100 diam.
Fig. 10. Villi from the surface of the ventricle of the heart (pathological). Cam. luc. × 100 diam.
Fig. 11. *a*, Posterior; *b*, anterior part of the salivary gland.
Fig. 12. *a*, Hermaphrodite duct; *b*, its ampulla; *c*, constricted part of the same; *d*, female branch; *e*, male branch; *f*, prostate; *g*, thinner part of the vas deferens; *h*, thicker part; *ii*, penis; *k*, vestibular gland.

Fig. 13. *Discodoris morphæa*, Bergh.

Fig. 13. *a*, Ampulla of the hermaphrodite duct; *b*, female branch; *c*, male branch; *d*, prostate; *e*, vas deferens; *f*, penis.

Figs. 14–20. *Ceratosoma cornigerum*, Adams.

Fig. 14. Otocyst on the surface of cerebral ganglion (*a*). Cam. luc. × 350 diam.
Fig. 15. Spicules from capsule of cerebral ganglion. Cam. luc. × 350 diam.
Fig. 16. Hooks of the labial disk. Cam. luc. × 750 diam.
Fig. 17. Part of the rhachis of the radula; *a*, median rhachidian thickening of cuticle; *b*, *b*, innermost lateral teeth (from the inner side). Cam. luc. × 750 diam.
Fig. 18. Lateral tooth, from behind. Cam. luc. × 750 diam.
Fig. 19. Two lateral teeth from the middle of a series, from the side. Cam. luc. × 750 diam.
Fig. 20. Part of the rhachis; *aa*, *b*, *b*, as in fig. 17. Cam. luc. × 350 diam.

Figs. 21–25. *Thordisa* (?) *clandestina*, Bergh.

Fig. 21. Part of the rhachis of the radula, with the innermost teeth of two series. Cam. luc. × 350 diam.
Fig. 22. Outermost portion of three series of teeth with 3–5 teeth; *a*, of the fourth; *b*, of the sixth complete row of the tongue. Cam. luc. × 350 diam.
Fig. 23. Innermost teeth of two series, from the side. Cam. luc. × 750 diam.
Fig. 24. A lateral tooth, from the side. Cam. luc. × 750 diam.
Fig. 25. Outermost portion of two series of teeth, with 5 and 7 teeth; *a*, *a*, outermost teeth. Cam. luc. × 750 diam.

Figs. 26–29. *Chromodoris striatella*, Bergh.

Fig. 26. Elements of the labial plate. Cam. luc. × 750 diam.
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Fig. 28. Second lateral tooth, viewed obliquely from inside. Cam. luc. × 750 diam.
Fig. 29. Outer portion of a series with seven plates; *a*, outermost tooth. Cam. luc. × 750 diam.

Fig. 30. *Euplocamus japonicus*, Bergh.

Fig. 30. Spicules of the skin. Cam. luc. × 200 diam.

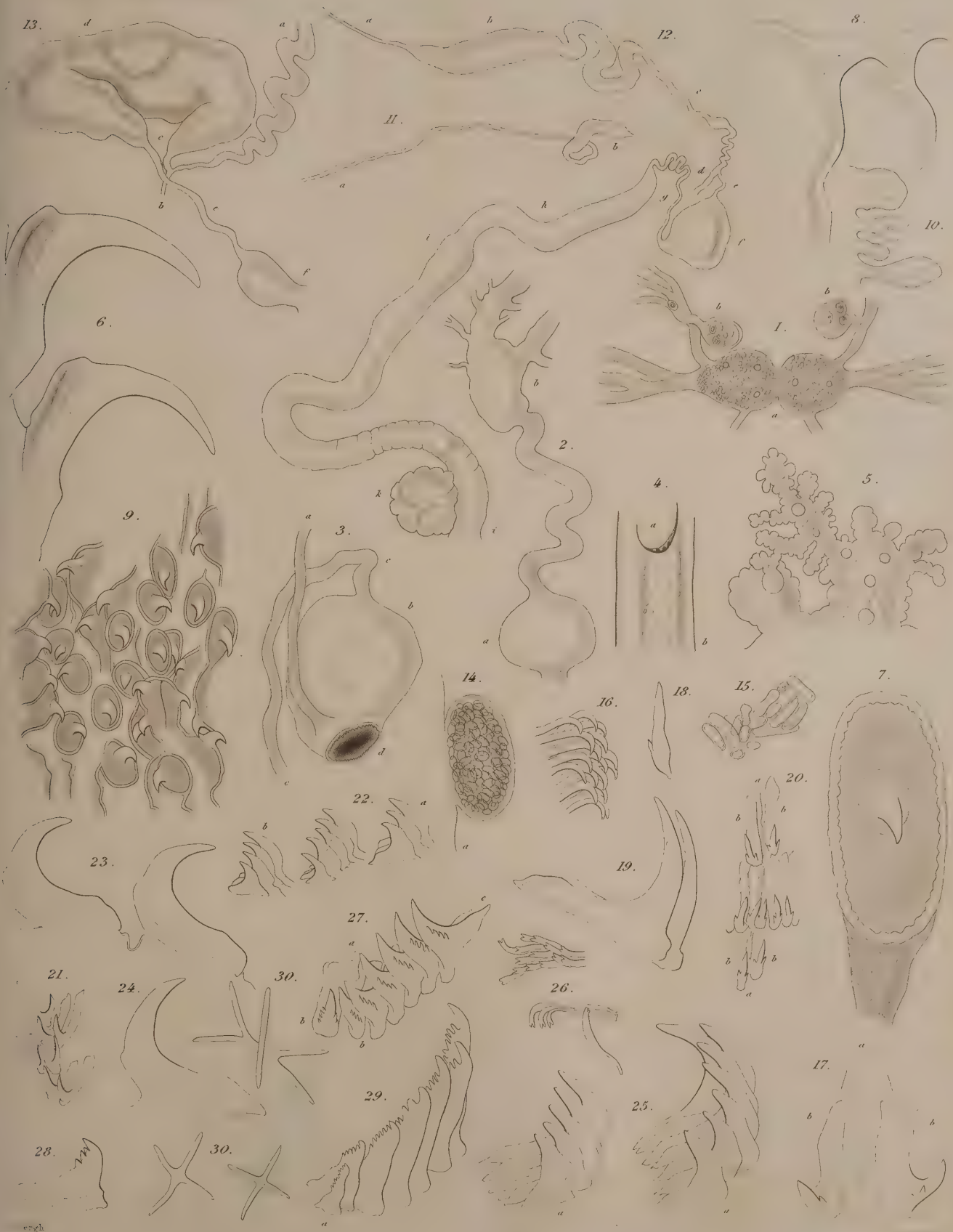
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PLATE IV.

PLATE IV.

Figs. 1–4. *Chromodoris striatella*, Bergh.

Fig. 1. *a*, *a*, Buccal; *b*, *b*, gastro-œsophageal ganglia. Cam. luc. × 100 diam.

Fig. 2. Two teeth from the outermost third of a series of teeth. Cam. luc. × 750 diam.

Fig. 3. *a*, Truncus aortæ; *b*, the ventricle; *c*, atrium; *dd*, hinder part of renal organ, in the middle is the renal chamber with its continuation into the ureter, on the right side the renal syrinx with its duct, behind the vena hepatica magna.

Fig. 4. *a*, Spermatheca; *b*, vaginal duct; *c*, uterine duct; *d*, spermatocyst.

Figs. 5, 6. *Doriopsis nebulosa*, Pease.

Fig. 5. Everted glans penis, showing *a*, armature continuous with that in interior of vas deferens. Cam. luc. × 350 diam.

Fig. 6. End of glans penis. Cam. luc. × 750 diam.

Figs. 7–24. *Euplocamus pacificus*, Bergh.

Fig. 7. Central nervous system, from the upper side; *a*, cerebral; *b*, *b*, visceral; *c*, *c*, pedal ganglia; *d*, common commissure; *e*, *e*, proximal olfactory ganglia; *f*, buccal ganglia. Cam. luc. × 100 diam.

Fig. 8. The same, from behind. Letters as above.

Fig. 9. Otocyst upon the surface of the ganglion (*a*). Cam. luc. × 350 diam.

Fig. 10. A spicule of the skin. Cam. luc. × 350 diam.

Fig. 11. Labial plate, from the inside; *a*, its upper end. Cam. luc. × 55 diam.

Fig. 12. The same, from the fore-end. Cam. luc. × 55 diam.

Fig. 13. Part of the radula, with 2 (3) series of teeth; *a*, *a*, first; *b*, *b*, second lateral teeth; *c*, *c*, outermost teeth. Cam. luc. × 100 diam.

Fig. 14. *a*, First, *b*, second, lateral tooth, from above. Cam. luc. × 200 diam.

Fig. 15. The same, from the side. Cam. luc. × 200 diam.

Fig. 16. First (innermost) and second of the outer teeth, from the inner side. Cam. luc. × 200 diam.

Fig. 17. *a*, Fourth; *b*, fifth tooth, from above. Cam. luc. × 200 diam.

Fig. 18. Outer teeth, from above; *a*, *a*, the innermost. Cam. luc. × 200 diam.

Fig. 19. Basal portion of teeth; *a*, third tooth; *b*, sixth. Cam. luc. × 350 diam.

Fig. 20. Fore end of armature of ductus ejaculatorius. Cam. luc. × 350 diam.

Fig. 21. Hinder end of same. Cam. luc. × 350 diam.

Figs. 22, 22. Part of cuticle with hooks. Cam. luc. × 750 diam.

Fig. 23. *a*, Basal portion of spermatheca; *b*, vaginal duct; *c*, vagina; *dd*, uterine duct; *e*, spermatocyst.

Fig. 24. *a*, Funiculus spermaticus; *b*, præputium penis.

Figs 25–27. *Onchidium melanopneumon*, Bergh.

Fig. 25. Tubercle of the skin.

Fig. 26. Bulbus pharyngeus, from above; *a*, radula-sheath.

Fig. 27. Rhachidian portion of the radula; *a*, median; *b*, *b*, first lateral; *c*, *c*, second lateral teeth. Cam. luc. × 350 diam.

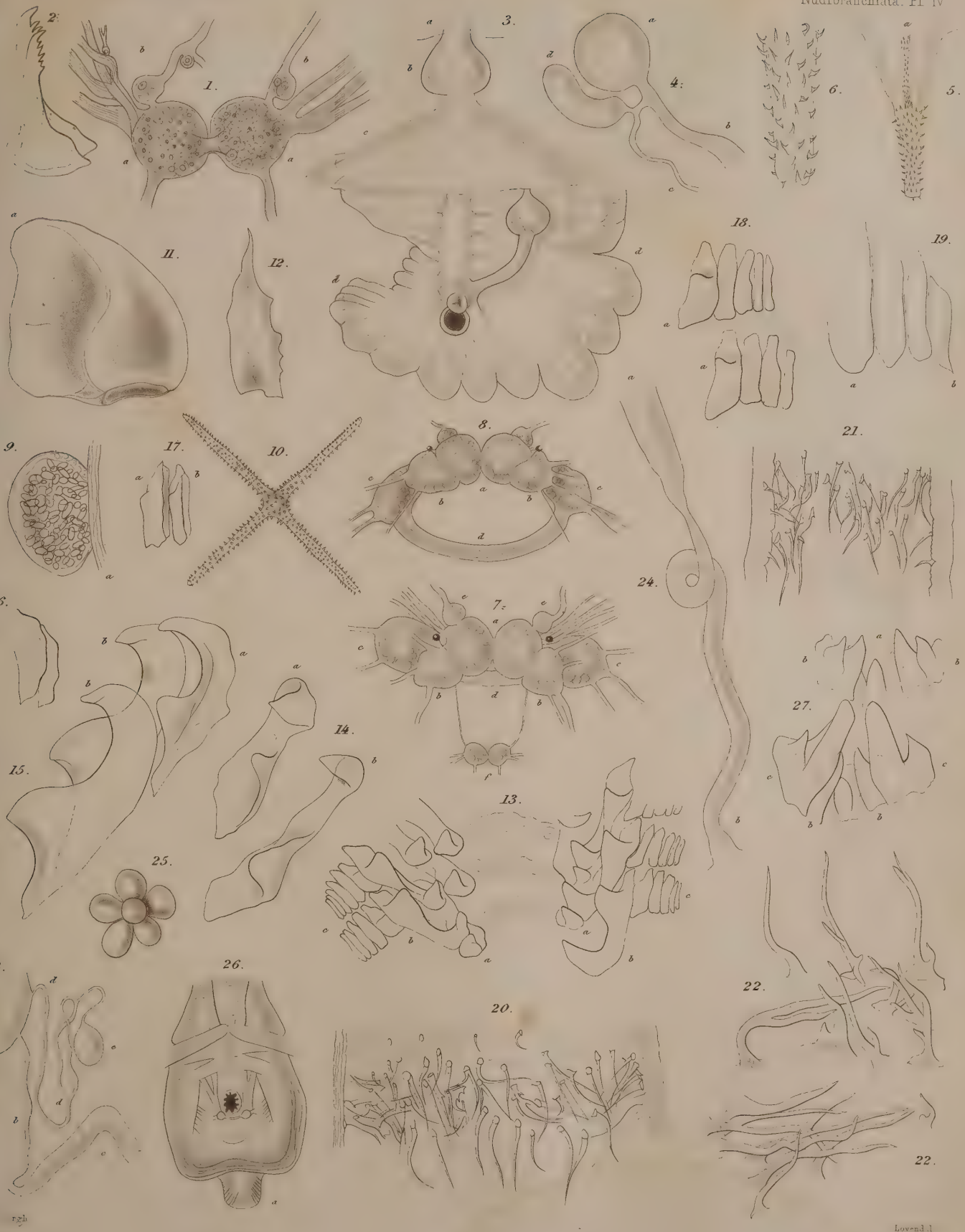
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PLATE V.

PLATE V.

Figs. 1–27. *Onchidium melanopneumon*, Bergh.

Fig. 1. Anterior end, showing rhinophoria, frontal shield (with orifice of penis), and the oral aperture.

Fig. 2. Posterior end of the animal (the tail turned upwards), viewed from beneath, showing anus, pneumostome, and (*a*), female genital furrow commencing at the vulva.

Fig. 3. Bulbus pharyngeus, from the side; *a*, pharynx; *b*, left buccal ganglion; *c*, protrusors of the bulbus; *d*, radula-sheath.

Fig. 4. Bulbus pharyngeus, opened on the upper side so as to show the tongue with radula (*a*); *b*, *b*, palatal plates, turned backwards.

Fig. 5. Portion of innermost part of palatal plates; *a*, free space between them. Cam. luc. × 55 diam.

Fig. 6. Part of palatal plates, from the side. Cam. luc. × 350 diam.

Fig. 7. *a*, First, *b*, second, lateral tooth. Cam. luc. × 350 diam.

Fig. 8. Second lateral tooth, obliquely from above. Cam. luc. × 350 diam.

Fig. 9. *a*, Second, *b*, third, *c*, fourth, lateral tooth, from the left side. Cam. luc. × 350 diam.

Fig. 10. Second tooth, from the side. Cam. luc. × 350 diam.

Fig. 11. Seventh tooth, from the inner side. Cam. luc. × 350 diam.

Fig. 12. First lateral tooth, from above. Cam. luc. × 350 diam.

Fig. 13. The same, from the outer side. Cam. luc. × 350 diam.

Fig. 14. Outer portion of two series of teeth, from the upper side; *a*, *a*, outermost teeth; *b*, tenth; *c*, eighth. Cam. luc. × 350 diam.

Fig. 15. Portion of outer end of two series of teeth, from below; *a*, *a*, outermost teeth. Cam. luc. × 350 diam.

Fig. 16. Part of external sixth of two series, from below; *a*, *a*, innermost of these teeth. Cam. luc. × 350 diam.

Fig. 17. Outermost tooth, from the outer side; *a*, cuticular folds. Cam. luc. × 350 diam.

Fig. 18. Outermost but two, from the outer side. Cam. luc. × 350 diam.

Fig. 19. Outermost three teeth, from behind; *a*, the outermost. Cam. luc. × 750 diam.

Fig. 20. Vertical section of lung and renal organ; *a*, pneumostome; *b*, dorsal surface.

Fig. 21. Lamellæ from third stomach, from the side.

Fig. 22. The same, from the end.

Fig. 23. Cuticle of second stomach. Cam. luc. × 55 diam.

Fig. 24. Section of dart-gland.

Fig. 25. Section of the ampulla of the dart-gland.

Fig. 26. The genital mass, seen obliquely from below; *a*, hermaphrodite gland; *b*, mucous gland, between them the spermatheca with its duct.

Fig. 27. The intestines from above; *a*, mouth-tube; *b*, bulbus pharyngeus with buccal ganglia; *c*, *c*, salivary glands; *d*, œsophagus; *ee*, intestine; *f*, anterior, *g*, posterior, liver; *h*, ampulla of duct of dart-gland; *i*, region of lung; *k*, heart (inner portion of pericardium left).

Figs. 28–31. *Doriopsis nebulosa*, Pease.

Fig. 28. *a*, Hermaphrodite duct; *b*, ampulla; *c*, oviduct; *dd*, prostate; *e*, muscular part of vas deferens; *f*, penis; *g*, spermatheca; *h*, vaginal duct; *i*, vagina; *k*, uterine duct; *l*, spermatocyst.

Fig. 29. Terminal part of vagina; *aa*, cuticular lining. Cam. luc. × 350 diam.

Fig. 30. Anterior armature of vas deferens (glans). Cam. luc. × 750 diam.

Fig. 31. Posterior armature of the same. Cam. luc. × 750 diam.

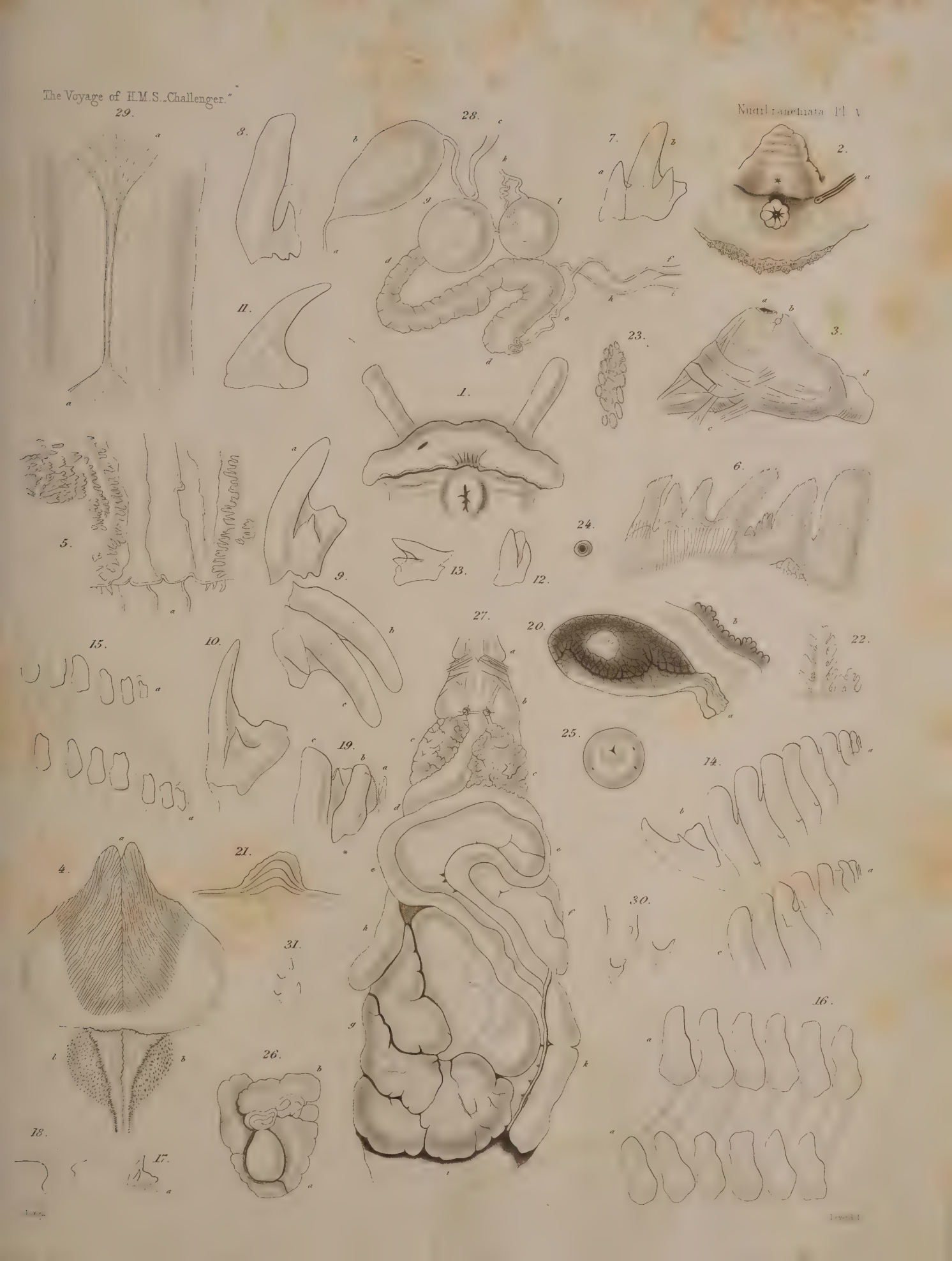
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PLATE VI

PLATE VI.

Figs. 1–4. *Chromodoris runcinata*, Bergh.

Fig. 1. Elements of the armature of labial disk. Cam. luc. × 750 diam.

Fig. 2. Outer part of three series of teeth; *a*, two outermost; *b*, second and third; *c*, third. Cam. luc. × 750 diam.

Fig. 3. Two teeth from the middle of a series. Cam. luc. × 350 diam.

Fig. 4. *a*, Spermatheca; *b*, vaginal duct; *c*, vagina; *d*, uterine duct; *e*, spermatocyst.

Figs. 5–18, 20, 21. *Onchidium melanopneumon*, Bergh.

Fig. 5. Median part of two series of teeth; *a*, median; *b*, *b*, *b*, *b*, first lateral teeth. Cam. luc. × 350 diam.

Fig. 6. *a*, Pharynx; *b*, œsophagus; *c*, superior bile duct; *d*, inferior bile duct; *e*, first stomach; *f*, second stomach; *g*, posterior bile duct; *h*, third stomach; *i*, ampulla of *k*, intestine.

Fig. 7. The same from the side; *b*, *c*, *e*, *f*, as above; *d*, inferior liver; *g*, posterior liver.

Fig. 8. Longitudinal section of inferior half of second stomach; *a*, opening into first stomach; *b*, recess in its cavity; *c*, posterior bile duct.

Fig. 9. Transverse section of the same.

Fig. 10. *a*, Posterior bile duct, with isolated small hepaticula.

Fig. 11. Part of atrium cordis, with *a*, atrio-ventricular valves.

Fig. 12. *a*, Hermaphrodite gland with coiled duct; *b*, mucous gland; *c*, duct of mucous gland (vagina); *dd*, vas deferens enclosed in the body wall (*cf.* fig. 21*c*); *ef*, its coiled-up portion lying in body cavity and ending in the penis, *g*; *h*, dart-gland; *ii*, ampulla of the duct (*k*); *l*, dart-sac.

Fig. 13. Lobules of hermaphrodite gland; *a*, duct. Cam. luc. × 100 diam.

Fig. 14. *a*, Common orifice (with protrusors) of dart sac *b*, and præputium *h*; *cc*, duct of (the ampulla of) the dart-gland; *d*, first free portion of vas deferens; *ee*, prostatic part of same; *fg*, muscular part; *h*, præputium; *i*, retractor muscle of the penis; *k*, its continuation into the common sac of præputium and dart.

Fig. 15. *a*, Common sac opened; *b*, præputium; *c*, vas deferens; *d*, dart-sac opened containing dart-cone; *e*, duct of (the ampulla of) the dart-gland.

Fig. 16. Præputium opened to show glans; *a*, vas deferens.

Fig. 17. End of glans penis.

Fig. 18. The dart; *a*, point; *b*, base; *c*, wall of dart-cone; *d*, continuation of dart-duct. Cam. luc. × 100 diam.

Fig. 20. End of dart. Cam. luc. × 350 diam.

Fig. 21. Vertical section through body wall; *a*, internal part of genital furrow; *b*, external part; *c*, section of vas deferens.

Fig. 19. *Onchidium tonganum*, Quoy et Gaimard.

Fig. 19. Fore end of dart in various positions. Cam. luc. × 100 diam.

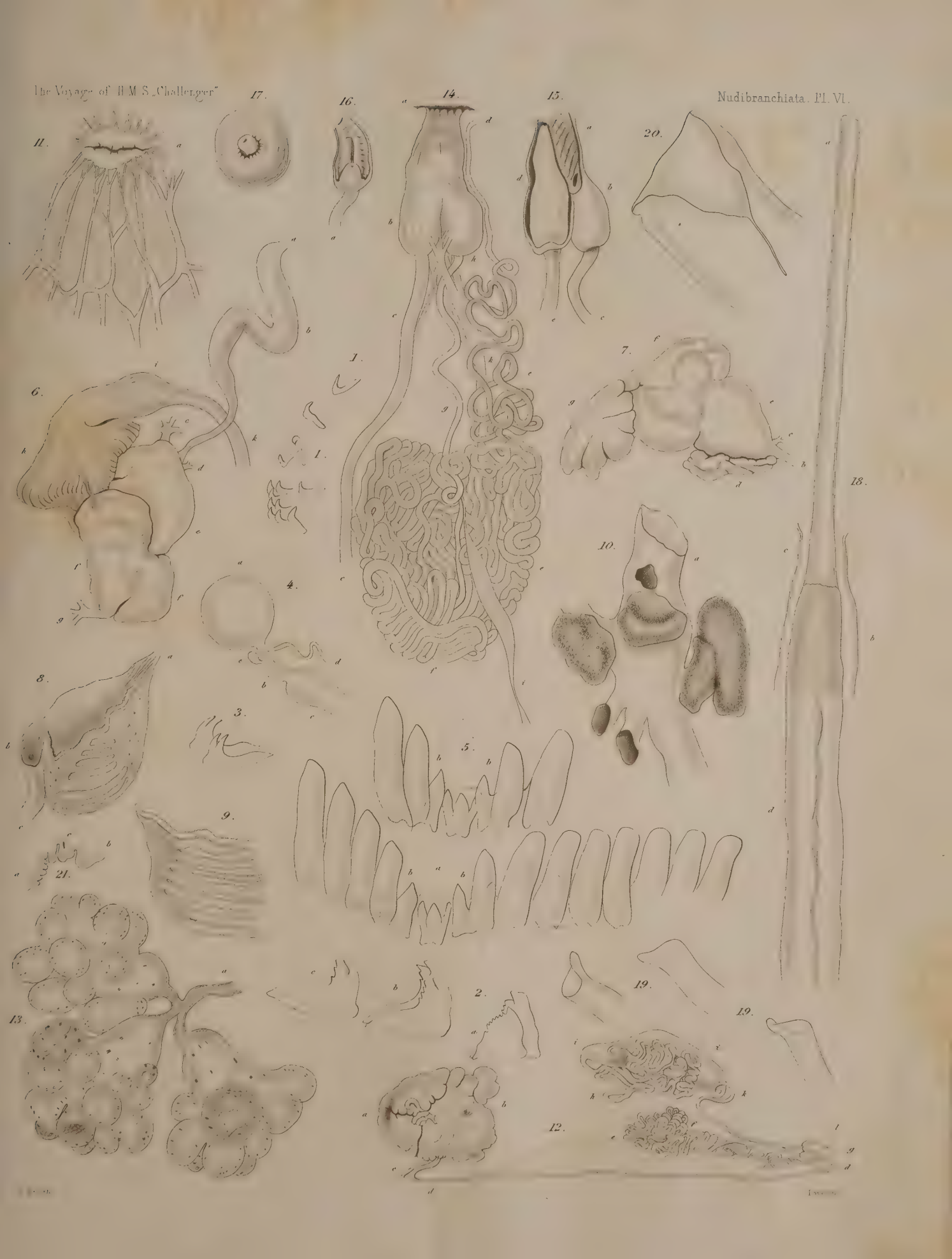

PLATE VII.

PLATE VII.

Figs. 1–6. *Onchidium tonganum*, Quoy et Gaimard.

Fig. 1. Vertical section through longitudinal axis of fore end of foot; *a*, fore end of foot; *b*, orifice of foot gland.

Fig. 2. Upper side of foot, from body cavity; *a*, mouth tube; *b*, foot gland; behind this the transverse muscular layer of foot, with entering nervi pediæi and opening of a vessel; *c*, *c*, longitudinal layers; *d*, muscles descending from the sides of the body.

Fig. 3. *a*, Præputium, opened and showing glans; *bb*, vas deferens; *c*, musculus retractor penis.

Fig. 4. End of glans penis; *a*, orifice at the point. Cam. luc. × 350 diam.

Fig. 5. *a*, Dart-cone opened; *b*, end of the duct of dart-gland; *c*, dart; *d*, nerve; *e*, retractor muscle.

Fig. 6. Dart; *a*, termination; *b*, base; *c*, duct. Cam. luc. × 100 diam.

Figs. 7–12. *Onchidium verruculatum*, Cuvier.

Fig. 7. Posterior end of body; *a*, pneumostome; *b*, anal papilla; *c*, vulva; *d*, genital furrow.

Fig. 8. Anterior end of foot from body cavity; *a*, mouth tube; *b*, foot gland; *c*, transverse muscular layer of foot.

Fig. 9. Portion of rhachis of radula; *a*, *a*, three median teeth; *b*, *b*, first lateral teeth.. Cam. luc. × 350 diam.

Fig. 10. End of a lobule of salivary gland. Cam. luc. × 55 diam.

Fig. 11. End of (*d*) duct of dart-gland; *a*, dart-cone; *b*, dart; *c*, base of dart. Cam. luc. × 100 diam.

Fig. 12. End of dart; *a*, opening at its extremity. Cam. luc. × 750 diam.

Figs. 13–22. *Bornella excepta*, Bergh.

Fig. 13. Anterior end of animal, from the side; *a*, mouth; *b*, tentacles; *c*, anterior part of rhinophore with club and sheath; *d*, papillary part.

Fig. 14. The club of the rhinophore and its sheath, from above; *a*, part connecting it with the papillary part.

Fig. 15. Part of the labial disk; *a*, fore-end of the rods. Cam. luc. × 750 diam.

Fig. 16. Three lateral teeth of anterior incomplete series. Cam. luc. × 350 diam.

Fig. 17. Lobule of hermaphrodite gland; *a*, duct.

Fig. 18. Anterior part of the penis; *a*, orifice of seminal duct.

Fig. 19. Posterior part of the same.

Fig. 20. Constriction (*a*) between (*c*) prostatic and (*b*) muscular part of the vas deferens.

Fig. 21. Part of the margin of the penis. Cam. luc. × 100 diam.

Fig. 22. A single spine from the penis; *a*, base. Cam. luc. × 350 diam.

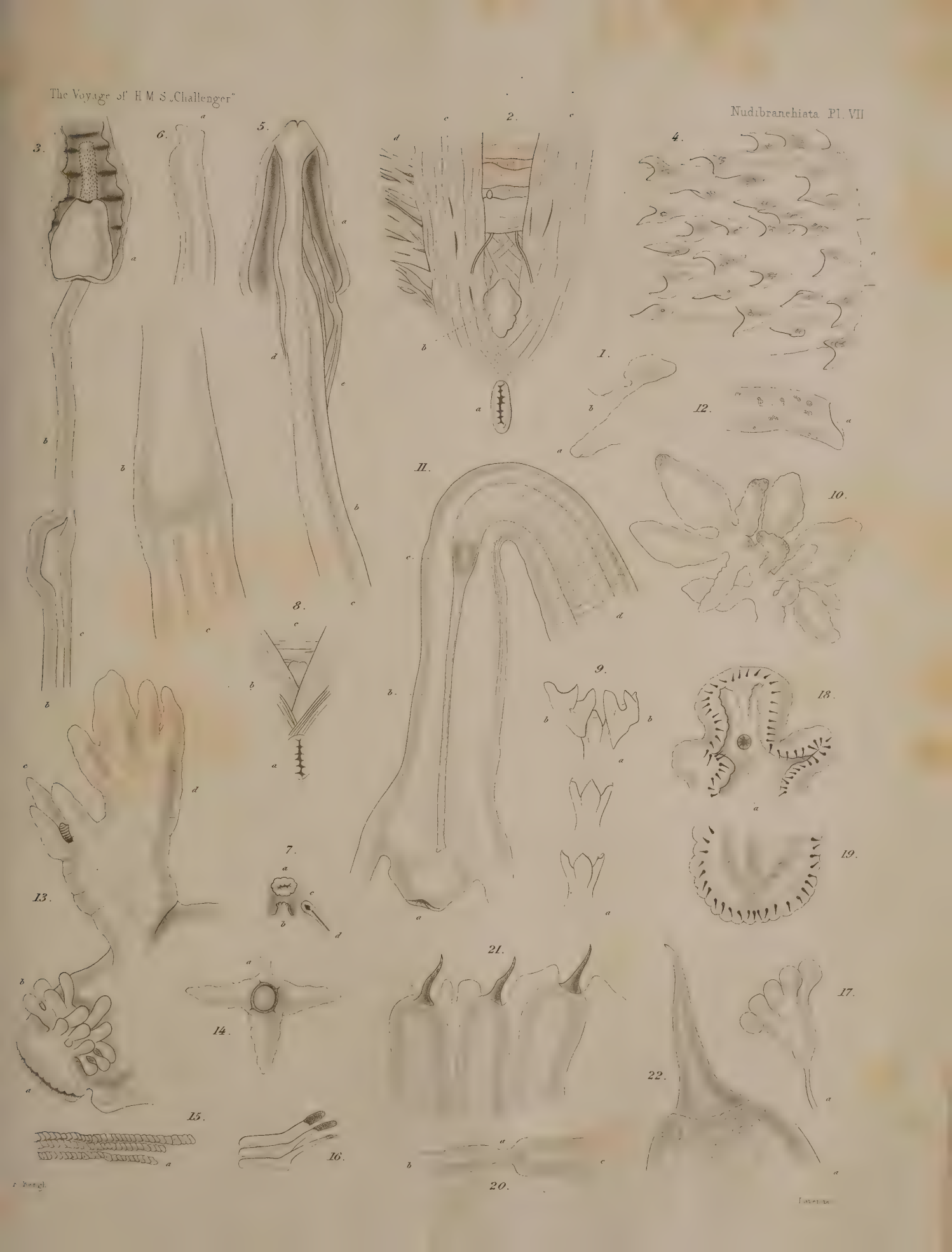
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PLATE VIII.

PLATE VIII.

Figs. 1–13. *Bornella excepta*, Bergh.

Fig. 1. Foremost papilla of left side, from the outer side ; *aa*, the back.

Fig. 2. Left mandible, from the outside ; *a*, hinge ; *b*, margo masticatorius. Cam. luc. × 55 diam.

Fig. 3. Upper part of left mandible ; *a*, hinge ; *b*, facet beneath the hinge. Cam. luc. × 55 diam.

Fig. 4. Two median teeth, from beneath. Cam. luc. × 350 diam.

Fig. 5. A median tooth, from the side. Cam. luc. × 350 diam.

Fig. 6. Median teeth, from the side. Cam. luc. × 350 diam.

Fig. 7. Median portion of radula, from above ; *a*, median ; *b*, *b*, first lateral ; *c*, fifth lateral tooth. Cam. luc. × 750 diam.

Fig. 8. Outermost part of two series, with 4–5 teeth ; *a*, *a*, outermost ; *c*, fifth. Cam. luc. × 750 diam.

Fig. 9. Digestive tract from beneath ; *a*, œsophagus ; *b*, first stomach ; *c*, *c*, two anterior liver masses with their ducts ; *d*, main liver mass, *e*, its duct ; *f*, second stomach ; *g*, first part of intestine ; *h*, constriction dividing it from the second portion, *ik*.

Fig. 10. Series of chitinous prickles from the second stomach. Cam. luc. × 100 diam.

Fig. 11. End of prickle. Cam. luc. × 350 diam.

Fig. 12. End of a renal tubule. Cam. luc. × 100 diam.

Fig. 13. Hermaphrodite gland ; *a*, efferent duct of this and another gland.

Fig. 14. *Onchidium verruculatum*, Cuvier.

Fig. 14. Dorsal tubercle with group of eyes.

Figs. 15–22. *Janolus australis*, Bergh.

Fig. 15. Bulbus pharyngeus, from the side ; *a*, musculus transversus postero-superior ; *b*, hinge part of mandibles ; *c*, œsophagus.

Fig. 16. Left mandible, from the outer side ; *a*, hinge part ; *b*, margo masticatorius.

Fig. 17. The same, from the inner side ; *a* and *b*, as above.

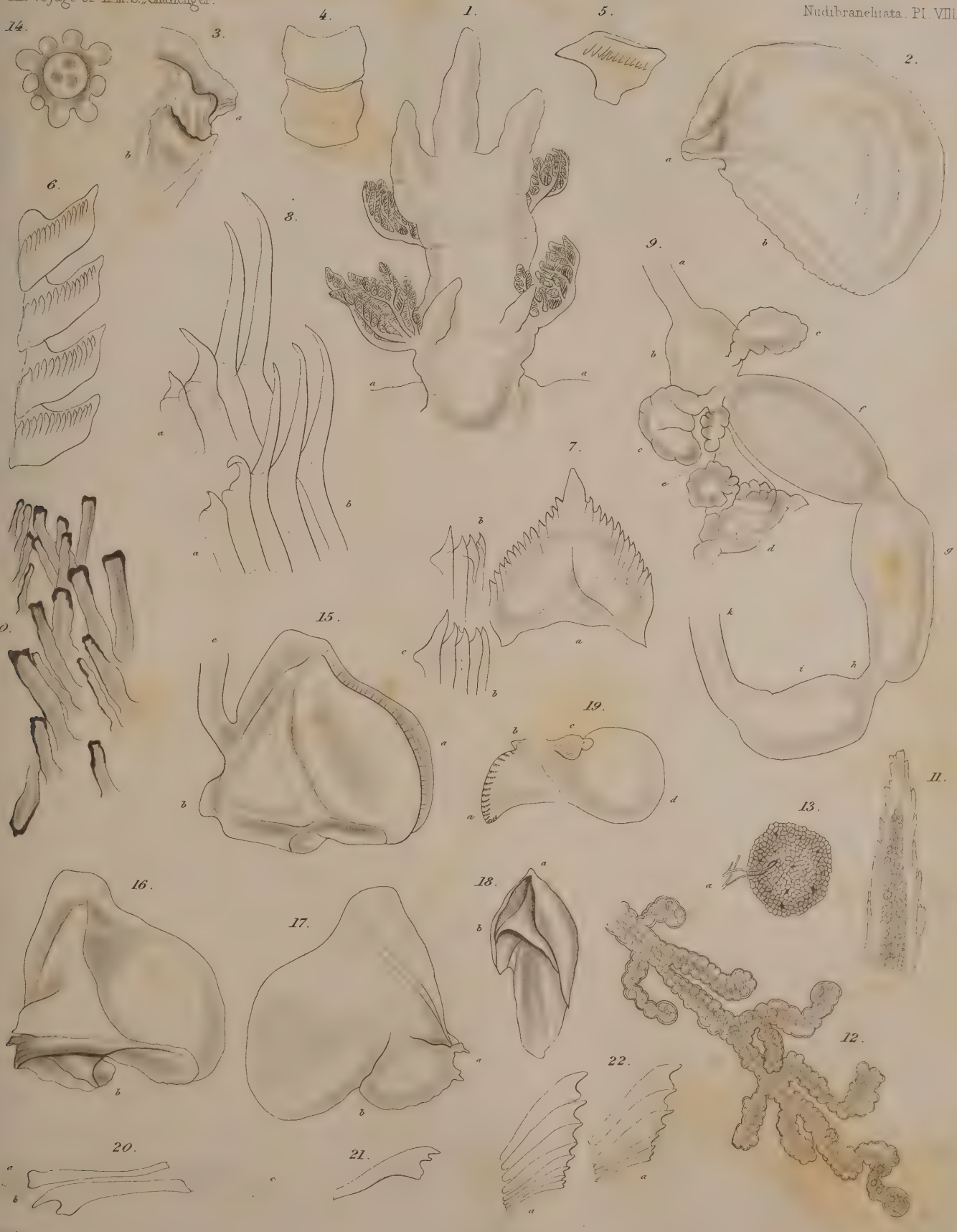
Fig. 18. The same, from beneath ; *a*, anterior end ; *b*, margo masticatorius.

Fig. 19. *a*, Tongue ; *b*, tectum radulæ ; *c*, vagina radulæ ; *d*, common muscular mass of the jaws.

Fig. 20. *a*, Median tooth from below ; *b*, first lateral tooth from the side ; *c*, cuticular continuation of teeth. Cam. luc. × 350 diam.

Fig. 21. Abnormal lateral tooth. Cam. luc. × 350 diam.

Fig. 22. Outer part of two series of teeth, with eight and seven teeth ; *a*, *a*, outermost teeth. Cam. luc. × 350 diam.



P. Bergh

Lemaitre

PLATE IX.

PLATE IX.

Figs. 1–5. *Rizzolia australis*, Bergh.

Fig. 1. Part of margo masticatorius; *a*, processus masticatorius. Cam. luc. × 350 diam.

Fig. 2. Upper part of one of the teeth from radula. Cam. luc. × 350 diam.

Fig. 3. Two teeth, obliquely from the side. Cam. luc. × 200 diam.

Fig. 4. Another, in a similar position. Cam. luc. × 200 diam.

Fig. 5. A single tooth, obliquely from above. Cam. luc. × 200 diam.

Figs. 6–8. *Janolus australis*, Bergh.

Fig. 6. Central nervous system, from above; *ab*, cerebro-pleural ganglia; *c, c*, pedal ganglia; *d, d*, eyes. Cam. luc. × 55 diam.

Fig. 7. Median part of the radula (two series); *a, a*, median teeth; *b*, cuticular continuation of the same; *c, c*, first lateral plates. Cam. luc. × 350 diam.

Fig. 8. Outermost part of a series of teeth; *a*, outermost tooth. Cam. luc. × 350 diam.

Figs. 9–22. *Ohola pacifica*, Bergh.

Fig. 9. The animal, from above; *a, a*, posterior papillæ.

Fig. 10. Mandibular plate; *a*, transverse; *b*, longitudinal part. Cam. luc. × 100 diam.

Fig. 11. Part of the radula, with three series of teeth; *a*, rhachis with its folds; *b, b*, first lateral teeth; *c, c, c, c*, second lateral teeth; *d, d, d*, innermost external teeth; *e, e, e*, outermost external teeth. Cam. luc. × 200 diam.

Fig. 12. First lateral tooth, from the inner side. Cam. luc. × 350 diam.

Fig. 13. The same, in another position. Cam. luc. × 350 diam.

Fig. 14. *a*, First; *b*, second lateral tooth, from the inner side. Cam. luc. × 350 diam.

Fig. 15. Part of radula; *a, a*, second lateral teeth; *b*, innermost external tooth; *c*, outermost tooth. Cam. luc. × 350 diam.

Fig. 16. The two external plates; *a*, innermost. Cam. luc. × 350 diam.

Fig. 17. Innermost external plate, from the side. Cam. luc. × 350 diam.

Fig. 18. Anterior part of the armature of the vas deferens; *a, a*, walls of the vas deferens proper. Cam. luc. × 750 diam.

Fig. 19. Median part of the same; *a* as above. Cam. luc. × 750 diam.

Fig. 20. Posterior part of the same. Cam. luc. × 750 diam.

Fig. 21. Part of the renal tubules. Cam. luc. × 350 diam.

Fig. 22. *a*, Intestine; *b*, urethra *c*, end of the renal chamber; *d*, renal syrinx; *e*, pericardium.

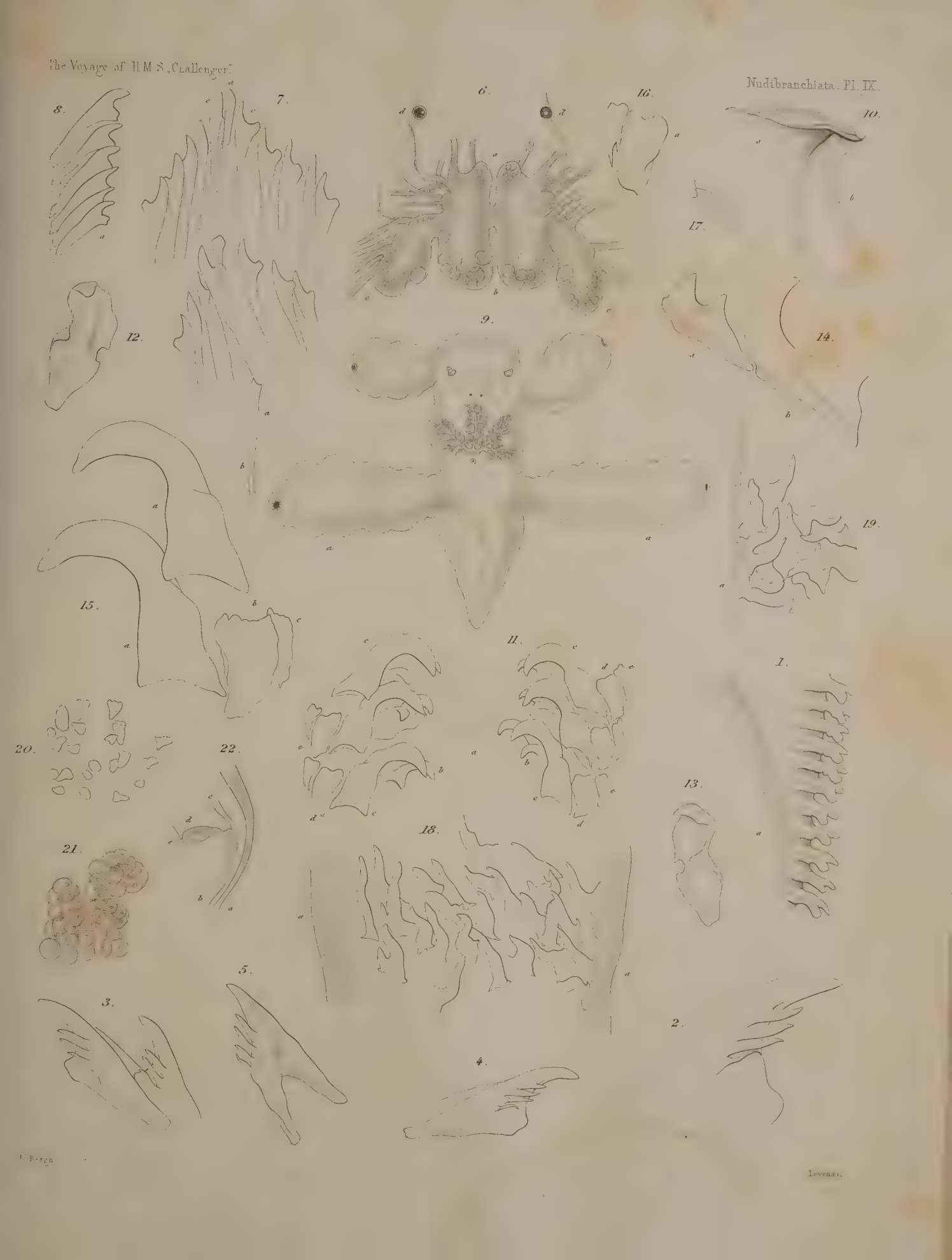

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PLATE X.

PLATE X.

Figs. 1–3. *Cuthonella abyssicola*, Bergh.

Fig. 1. The left mandible, from the outside, without being pressed; *a*, hinge with crista connectiva (on the inner side); *b*, end of processus masticatorius; *c*, the posterior limit of the succenturiate buccal cavity (Neben-mundhöhle). Cam. luc. × 55 diam.

Fig. 2. *aa*, The ejaculatory duct; *b*, side-duct from a gland (?); *cc*, the base of the præputium; *d*, glans penis; *e*, point of the penis. Cam. luc. × 55 diam.

Fig. 3. *a*, Spermatheca; *b*, duct of the same; *c*, opening in the vestibulum. Cam. luc. × 55 diam.

Fig. 4. *Acura pelagica*, Adams.

Fig. 4. The heart and the renal sac; *a*, pericardium; *b*, the atrium of the heart, and *c*, the aorta; *d*, renal syrinx; *e*, *e*, the renal chamber; *f*, the ureter. Cam. luc. × 55 diam.

Figs. 5–17. *Distomum glauci*, Bergh.

Fig. 5. The animal, from the under side; *a*, the oral, *b*, the ventral, sucker; *c*, the aperture through which the tail is retracted; the cavity of the body nearly filled with yellow cells (eggs). Cam. luc.

Fig. 6. Another individual in the same position; *a* and *b*, as above; *c*, the tail (with its retractors). Cam. luc.

Fig. 7. Another individual, from the side; *a*, *b*, *c*, as above; behind the oral sucker the genital papilla, along each side of the body the branch of the intestine. Cam. luc.

Fig. 8. Another individual, in similar position; *a*, *b*, *c*, as above; in the tail the branches of the intestine and the two egg-sacs. Cam. luc.

Fig. 9. The anterior half of an individual; *a*, the oral sucker; *b*, the genital papilla; *c*, the ventral sucker along the sides of the body the branch of the digestive channel (*d*). Cam. luc.

Fig. 10. A small individual without tail. Cam. luc.

Fig. 11. *a*, The oral sucker; *b*, *b*, the branches of the digestive channel; *c*, the two anterior branches of *d*, the excretory organ; *e*, the ventral sucker; *f*, the vesicula seminalis. Cam. luc.

Fig. 12. *a*, The left branch of the digestive channel; *b*, end of the excretory duct; *c*, *c*, the posterior end of the branches of the digestive channel (in the half-protruded tail). Cam. luc.

Fig. 13. Anterior end of the animal, with *a*, the oral sucker, and *b*, the genital papilla. Cam. luc.

Fig. 14. Another similar in somewhat different position. Cam. luc.

Fig. 15. The ventral sucker, from the side. Cam. luc.

Fig. 16. The genital papilla, with the penis covered with small prominences. Cam. luc.

Fig. 17. An egg. Cam. luc.

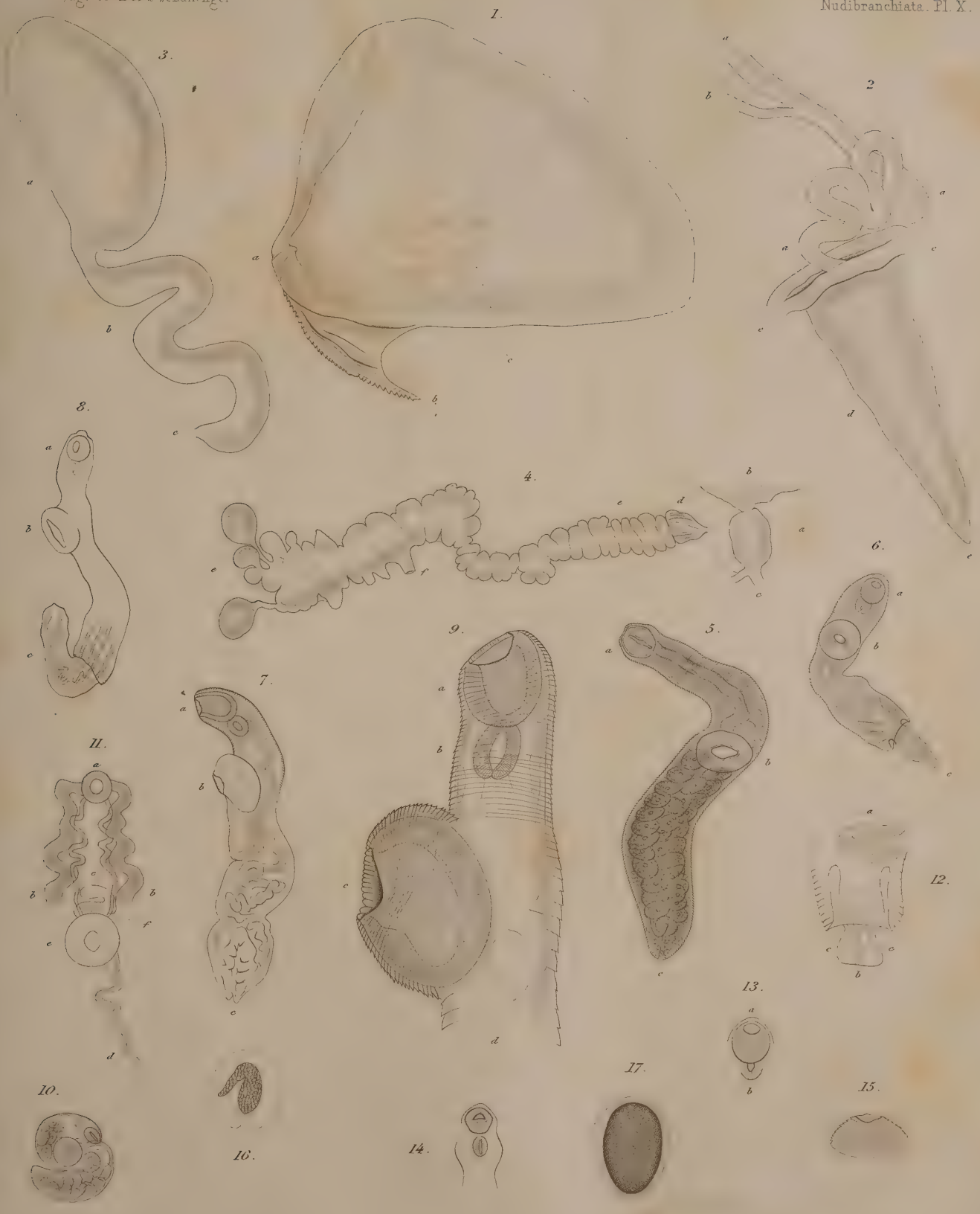
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PLATE XI.

PLATE XI.

Fig. 1. *Fiona marina* (Forskål).

Fig. 1. Loose plates of the radula, lying beneath the tongue in *a*, hindermost part of the buccal cavity (beneath the tongue). Cam. luc. × 100 diam.

Fig. 2. *Cuthonella abyssicola*, Bergh.

Fig. 2. Part of masticatory edge; *a*, hindermost part. Cam. luc. × 350 diam.

Figs. 3–15. *Marionia occidentalis*, Bergh.

Fig. 3. The central nervous system, from the under side; *a*, *b*, cerebro-pleural ganglia, with the otocysts; *c*, *c*, pedal ganglia; *d*, the united commissures; *e*, nervus genitalis; *f*, *f*, cerebro-buccal connective; *g*, buccal ganglia; *h*, *h*, gastro-œsophageal ganglia; *i*, the eye. Cam. luc. × 55 diam.

Fig. 4. The mandibles, from the anterior side; *a*, masticatory processes. Cam. luc.

Fig. 5. Part of the masticatory edge, from the inside; *a*, posterior part; *b*, anterior part. Cam. luc. × 350 diam.

Fig. 6. Upper part of the masticatory edge in the neighbourhood of the hinge, from the outside; *a*, anterior margin. Cam. luc. × 350 diam.

Fig. 7. Rhachidian part of the radula with two series; *a*, *a*, median plates; *b*, *b*, first lateral plates. Cam. luc. × 350 diam.

Fig. 8. Lateral plates, obliquely from the side. Cam. luc. × 350 diam.

Fig. 9. Lateral plate, from the side. Cam. luc. × 350 diam.

Fig. 10. Lateral plates, obliquely from the side. Cam. luc. × 350 diam.

Fig. 11. Outer part of a series of plates with four plates; *a*, outermost. Cam. luc. × 350 diam.

Fig. 12. The hook of a lateral plate. Cam. luc. × 750 diam.

Fig. 13. The largest of the stomachal plates. Cam. luc. × 55 diam.

Fig. 14. *a*, Spermatheca; *b*, its duct; *c*, vagina; *d*, vas deferens; *e*, glans penis.

Fig. 15. End of the glans penis; *a*, orifice of the seminal duct. Cam. luc. × 100 diam.

Figs. 16–19. *Tritonia challengeriana*, Bergh.

Fig. 16. The mandibles from the anterior side; *a*, masticatory processes. Cam. luc.

Fig. 17. Part of the masticatory edge; *a*, innermost part; *b*, anterior margin. Cam. luc. × 350 diam.

Fig. 18. Rhachidian part of a series of plates; *a*, median; *b*, *b*, first lateral plates; *c*, third plate. Cam. luc. × 350 diam.

Fig. 19. *aa*, Ductus ejaculatorius; *b*, præputium; *c*, *c*, musculi retractores penis; *d*, glans penis.

Fig. 20. *Scyllæa pelagica*, Linné.

Fig. 20. *a*, End of the ductus ejaculatorius; *b*, the half of the præputium taken away and the glans penis denuded.

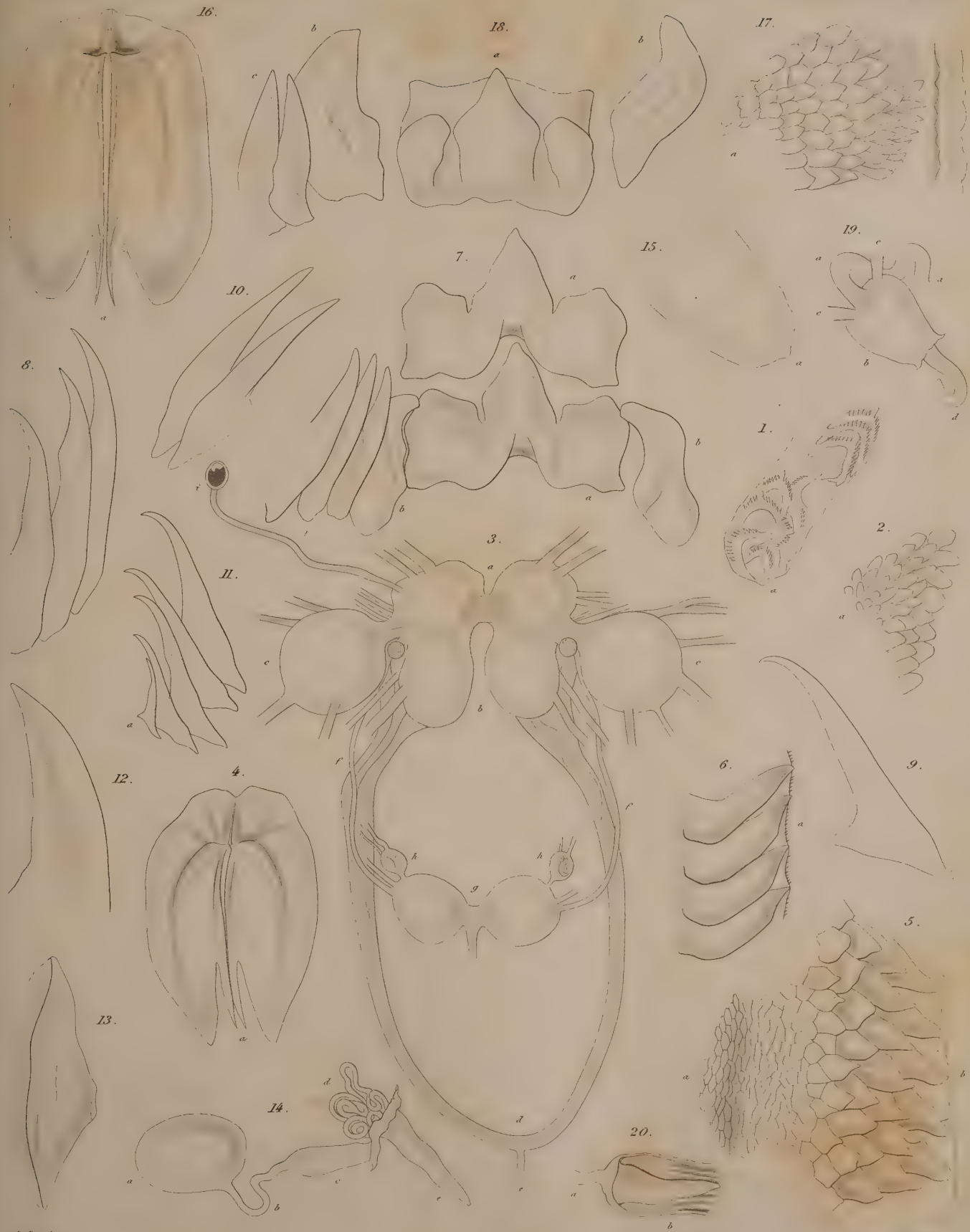
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PLATE XII.

PLATE XII.

Figs. 1–8. *Tritonia challengeriana*, Bergh.

Fig. 1. First lateral plate, from above. Cam. luc. × 350 diam.

Fig. 2. A lateral plate, from the outer side. Cam. luc. × 350 diam.

Fig. 3. Another, seen (shortened) from the inner side. Cam. luc. × 350 diam.

Fig. 4. Another, from the side. Cam. luc. × 350 diam.

Fig. 5. The broken point of the hook of a lateral plate. Cam. luc. × 350 diam.

Fig. 6. The outer part of four series with one to three plates; *a*, *a*, outermost. Cam. luc. × 350 diam.

Fig. 7. *a*, Renal syrinx; *b*, root of the duct of the organ.

Fig. 8. *a*, Spermatheca; *b*, its duct; *c*, the vagina.

Figs. 9–13. *Cuthonella abyssicola*, Bergh.

Fig. 9. *a*, Anus; *b*, renal pore; *c*, upper end of two series of papillæ belonging to the second group.

Fig. 10. Genital papilla with end of the glans; behind this the vulva (vagina) and aperture of the duct of the mucous gland.

Fig. 11. Basal plate of a lingual plate, from the under side. Cam. luc. × 350 diam.

Fig. 12. The point of the hook, from above. Cam. luc. × 350 diam.

Fig. 13. Two plates, from the side. Cam. luc. × 350 diam.

Figs. 14–20. *Bathydoris abyssorum*, Bergh.

Fig. 14. Fore-end of the animal, from the under side; *a*, *a*, rhinophoria; *b*, sole of the foot; *c*, genital papilla, with the præputium (and the point of the glans penis) and the aperture of the duct of the mucous gland. Natural size.

Fig. 15. Hinder end of the animal; *a*, *a*, sides of the body; *b*, sole of the foot. Natural size.

Fig. 16. Part of the skin of the back with papillæ.

Fig. 17. A lateral tooth of the outer half of a row, from above. Cam. luc. × 100 diam.

Fig. 18. Similar, from below. Cam. luc. × 100 diam.

Fig. 19. Four lateral plates from the outer sixth part of a row, obliquely from the outside; *a*, the outer. Cam. luc. × 100 diam.

Fig. 20. Renal tubules, from the peritoneum. Cam. luc. × 100 diam.

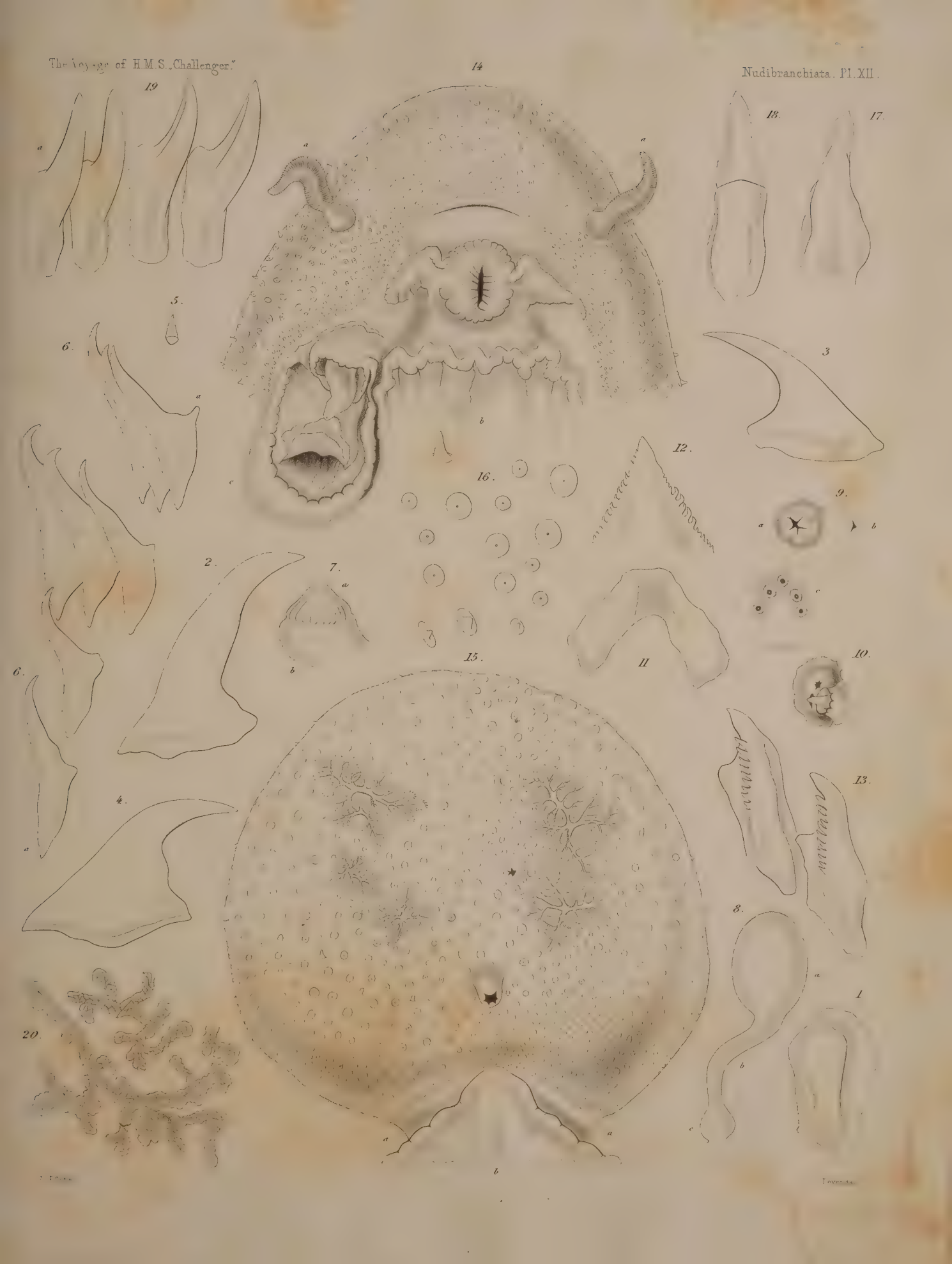
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PLATE XIII.

PLATE XIII.

Bathydoris abyssorum, Bergh.

Fig. 1. The animal on a reduced scale, from the anterior.

Fig. 2. The bulbus pharyngeus, from the side; *a*, labial disk, with its strong retractor muscles; *b*, *b*, muscular mass on the foreside of the mandibles; *c*, end of the radula sheath; *d*, end of the salivary gland, with its duct passing over the buccal commissure; *e*, the root of the œsophagus, with the right buccal ganglion.

Fig. 3. The same, from above; *a*, *b*,*b*, and *e*, as in fig. 2.

Fig. 4. Foreside of the mandibles, united by the thick cuticle of the buccal cavity (*cf.* fig. 6*b*), after the removal of muscular mass, resting on their foreside; the right mandible overlapping the left; *a*, under end.

Fig. 5. The right mandible, from the foreside; *a*, upper; *b*, under end; opposite the fig. 5 is the tooth.

Fig. 6. Perpendicular section through the length of the bulbus pharyngeus near the middle line; *a*, *c*, *e*, as in fig. 2. Behind the labial disk (*a*) the part of the bulbus lying in front of the mandible, clothed with a thick cuticle (*b*); *d*, free part of the left mandible; behind this the tongue, and beneath a transverse section of the musculus lingualis inferior.

Fig. 7. Rhachidian part of a row of plates; *a*, median plate; *b*, *b*, first lateral plate; *c*, second; *d*, third lateral plate. Cam. luc. × 100 diam.

Fig. 8. Median plate, from the side. Cam. luc. × 100 diam.

Fig. 9. Two other median plates, from the side. Cam. luc. × 100 diam.

Fig. 10. First lateral plate, from above. Cam. luc. × 100 diam.

Fig. 11. Irregular first lateral plate, from the side. Cam. luc. × 100 diam.

Fig. 12. Second lateral plate, from above. Cam. luc. × 100 diam.

Fig. 13. Fourth (*a*) and fifth (*b*) lateral plates, from above. Cam. luc. × 100 diam.

Fig. 14. Sixth lateral plate, from above. Cam. luc. × 100 diam.

Fig. 15. Four lateral plates, from the inner third of the radula, from above; *a*, irregular plate with short hook. Cam. luc. × 100 diam.

Fig. 16. Two others; *a*, with short hook. Cam. luc. × 100 diam.

Fig. 17. A piece of the outer fifth of a row, with three plates, obliquely from above. Cam. luc. × 100 diam.

Fig. 18. A similar plate, from the side. Cam. luc. × 100 diam.

Fig. 19. A similar plate, from the under side. Cam. luc. × 100 diam.

Fig. 20. A quite irregular plate. Cam. luc. × 100 diam.

Fig. 21. A double plate, from above. Cam. luc. × 100 diam.

Fig. 22. Another, from the side. Cam. luc. × 100 diam.

Fig. 23. A worn lateral plate from the anterior rows of the tongue. Cam. luc. × 100 diam.

Fig. 24. A similar plate. Cam. luc. × 100 diam.

Fig. 25. Part of the upper portion of the ureter.

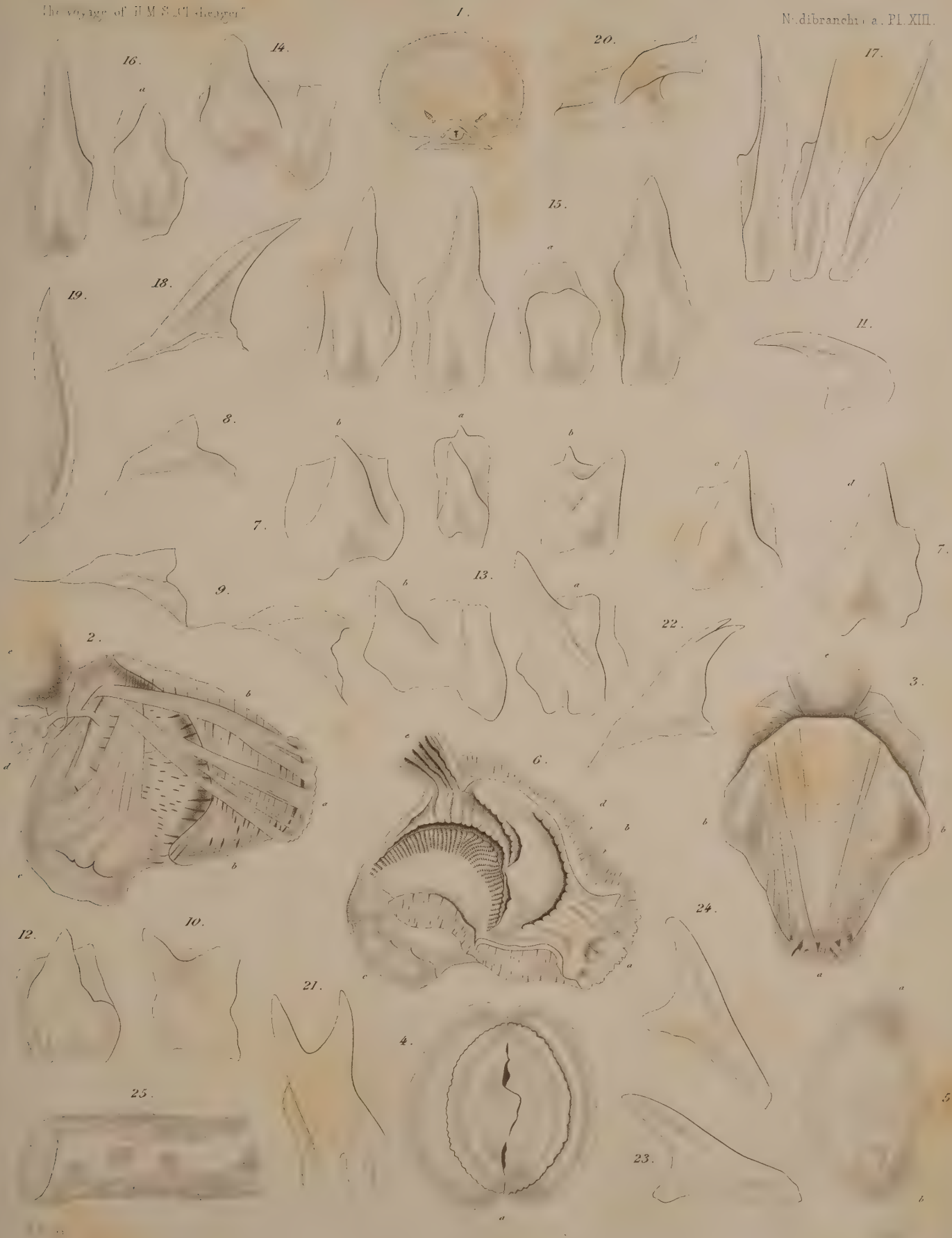
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PLATE XIV.

PLATE XIV.

Figs. 1–15. *Bathydoris abyssorum*, Bergh.

Figs. 1, 2. Papillæ of the back.

Fig. 3. A similar papilla; *a*, openings of the vessels and nerves.

Fig. 4. The central nervous system, from above; *a*, *a*, the cerebral ganglia; *b*, *b*, the two portions of the right pleural ganglion; *c*, pedal ganglion; *d*, the intercerebral and interpleural commissure; *e*, *e*, the cerebro-buccal connective; *f*, *f*, buccal ganglia; *g*, interbuccal commissure; *h*, common commissure. Cam. luc.

Fig. 5. Nerve ramification in the subcutaneous layer. Cam. luc. × 55 diam.

Fig. 6. *a*, The median plate; *b*, the first, and *c*, the second, lateral plate. Cam. luc. × 100 diam.

Fig. 7, 7. Part of the rhachis with four plates. Cam. luc. × 100 diam.

Fig. 8. First lateral plate of two series, from the side. Cam. luc. × 100 diam.

Fig. 9. Outer part of a series of plates (of the radula sheath) with nine plates, from the side; *a*, outermost. Cam. luc. × 100 diam.

Fig. 10. Outer part of two series of plates with nine and twelve plates, from above; *a*, *a*, the outermost. Cam. luc. × 100 diam.

Fig. 11. The hermaphrodite gland, from the under side, with the chief duct.

Fig. 12. Lobule of the gland.

Fig. 13. Zoosperm; *a*, head.

Fig. 14. *a*, Vas deferens; *b*, præputium; *c*, point of penis.

Fig. 15. Penis opened, with continuation of *a*, vas deferens out to the point *c*.

Glaucus atlanticus (Forster).

Fig. 16. Part of the margin of the processus masticatorius; *a*, behind. Cam. luc. × 750 diam.

Figs. 17, 18. *Tritonia challengeriana*, Bergh.

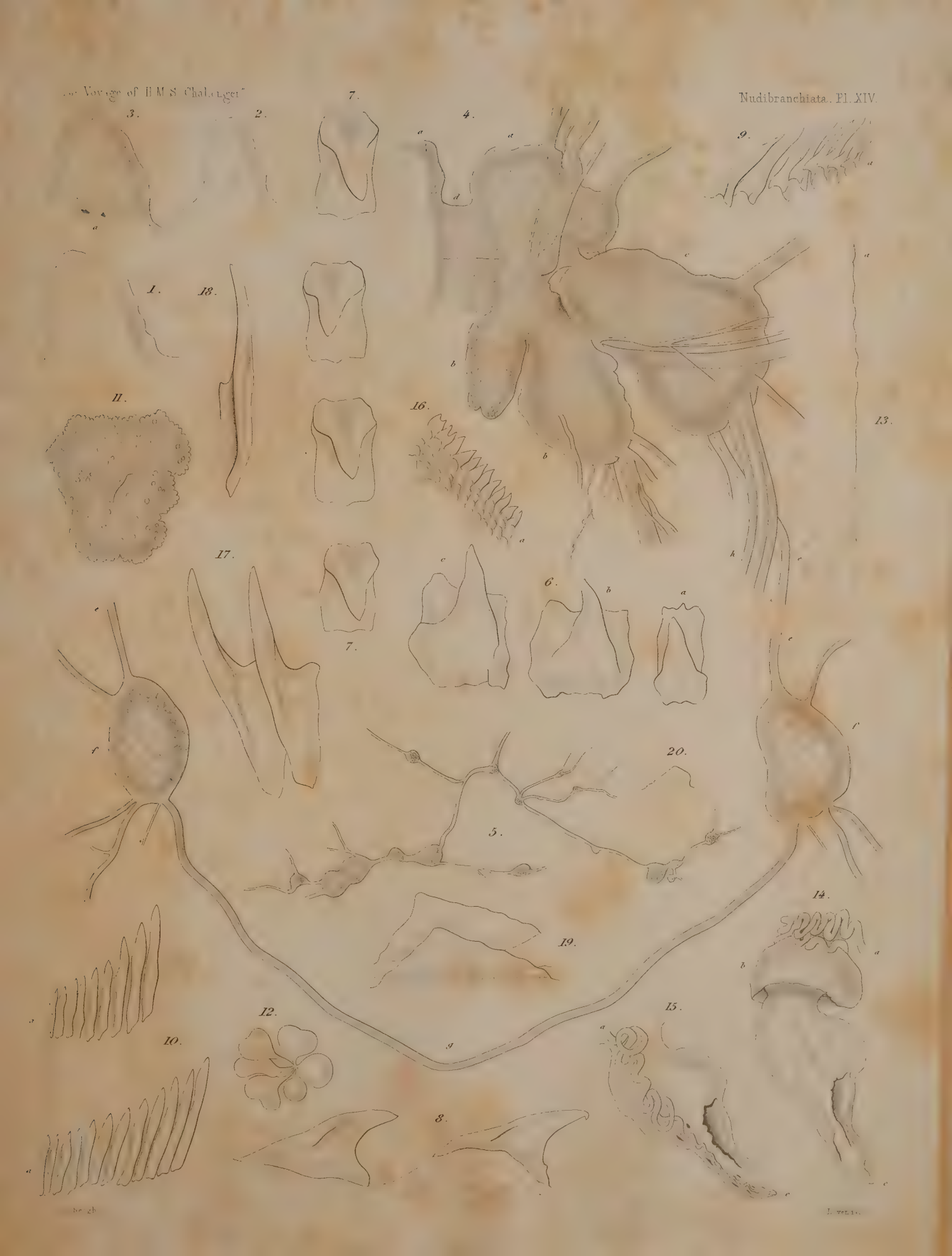
Fig. 17. Two lateral plates, obliquely from the inner side. Cam. luc. × 350 diam.

Fig. 18. A similar plate, more obliquely from the outer side. Cam. luc. × 350 diam.

Figs. 19, 20. *Marionia occidentalis*, Bergh.

Fig. 19. Masticatory plates of the stomach. Cam. luc. × 55 diam.

Fig. 20. One of the smallest plates. Cam. luc. × 55 diam.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